

# Quality Assurance Project Plan

## Lower Passaic River Restoration Project

RI Water Column Monitoring/High Volume Chemical Data Collection

Revision 1, September 2012



Prepared for:  
Cooperating Parties Group  
Newark, New Jersey

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**Quality Assurance Project Plan**

RI Water Column Monitoring/High Volume Chemical Data Collection

Lower Passaic River Restoration Project

New Jersey

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**Quality Assurance Project Plan****Remedial Investigation Water Column Monitoring/High Volume  
Chemical Data Collection****Lower Passaic River Restoration Project**

September 2012

Revision 1

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**List of Acronyms**

<b>Acronym</b>	<b>Definition</b>
%D	Percent Difference
%R	Percent Recovery
ADCP	Acoustic Doppler Current Profiler
APHA	American Public Health Association
ASTM	American Society for Testing and Materials
BOD	Biological Oxygen Demand
Br	Bromine
CA	Corrective Action
CARP	Contaminant Assessment and Reduction Program
CAS	Columbia Analytical Services
CAS Number	Chemical Abstracts Services Number
CCV	Continuing Calibration Verification
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
cfs	Cubic Feet per Second
CFT	Chemical Fate and Transport
Cl	Chlorine
CLH	Chemical Land Holdings
COC	Chain of Custody
COPC	Chemical of Potential Concern
CPG	Cooperating Parties Group
CPR	Cardiopulmonary Resuscitation
CSM	Conceptual Site Model
CSO	Combined Sewer Overflow
CWCM	Chemical Water Column Monitoring
ddms	de Maximis Data Management Solutions
dGPS	Differential Global Positioning System
DMP	Data Management Plan
DOC	Dissolved Organic Carbon
DoD	Department of Defense
DQI	Data Quality Indicators
DQO	Data Quality Objectives
EDD	Electronic Data Deliverable
EDL	Estimated Detection Limit
EDP	Electronic Data Processor
EHS	Environmental Health and Safety
EMBM	Empirical Mass Balance Model
EML	Estimated Minimum Level
EMPC	Estimated Maximum Possible Concentration

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ERA	Ecological Risk Assessment
FS	Feasibility Study
FSP	Field Sampling Plan
FTM	Field Task Manager
FWM	Food Web Model
g	Gram
H&S	Health and Safety
HASP	Health and Safety Plan
HAZWOPER	Hazardous Waste Operations and Emergency Response
HHRA	Human Health Risk Assessment
HOC	Hydrophobic Organic Compound
HpCDD	Heptachlorodibenzo-p-dioxin
HpCDF	Heptachlorodibenzofuran
HQI	HDR/HydroQual
Hr	Hour
HRGC/HRMS	High Resolution Gas Chromatography-High Resolution Mass Spectrometry
HSMVS	Hydrophobic Organic Compound Sampling Method Validation Study
HV	High Volume
HxCDD	Hexachlorodibenzo-p-dioxin
HxCDF	Hexachlorodibenzofuran
ICAL	Initial Calibration
ICV	Initial Calibration Verification
ID	Identification
K & L Gates	Kirkpatrick and Lockhart Preston Gates Ellis Limited Liability Partnership (LLP)
L	Liter
LBG	The Louis Berger Group, Inc.
LCS	Laboratory Control Sample
LCSD	Laboratory Control Sample Duplicate
LDC	Laboratory Data Consultants, Inc.
LFB	Laboratory Fortified Blank
LIMS	Laboratory Information Management System
LISST	Laser <i>In Situ</i> Scattering and Transmissiometry
LLP	Limited Liability Partnership
LOC	Level of Chlorination
LPR	Lower Passaic River
LPR/NB	Lower Passaic River/Newark Bay
LPRRP	Lower Passaic River Restoration Project
LPRSA	Lower Passaic River Study Area
LRC	Low Resolution Coring

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MB	Method Blank
MDL	Method Detection Limit
mg	Milligram
mg/kg	Milligram per Kilogram
mg/L	Milligram per Liter
min	Minute
mL	Milliliter
MPI	Malcolm Pirnie, Inc
MS	Matrix Spike
MSD	Matrix Spike Duplicate
N/A	Not Applicable
NA	Not Available
NB	Newark Bay
NBSA	Newark Bay Study Area
NIST	National Institute of Standards and Technology
NJDEP	New Jersey Department of Environmental Protection
NJDOT	New Jersey Department of Transportation
NOAA	National Oceanic and Atmospheric Administration
NY/NJ HEP	New York and New Jersey Harbor Estuary Program
OSI	Ocean Surveys Inc.
OU	Operable Unit
oz	Ounce
PAH	Polycyclic Aromatic Hydrocarbons
PAL	Project Action Level
PCB	Polychlorinated Biphenyl
PCDD	Polychlorinated Dibenzodioxins
PCDF	Polychlorinated Dibenzofurans
PCDD/Fs	Polychlorinated Dibenzodioxins/ Polychlorinated Dibenzofurans
PE	Performance Evaluation
PeCDD	Pentachlorodibenzo-p-dioxin
PeCDF	Pentachlorodibenzofuran
pg	Picogram
PFK	Perfluorokerosene
PM	Project Manager
POC	Particulate Organic Carbon
ppth	Part Per Thousand
PQO	Project Quality Objectives
PREmis	Passaic River Estuary Management Information System
PRP	Potential Responsible Party

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PUF	Polyurethane Foam
PWCM	Physical Water Column Monitoring
QA	Quality Assurance
QA/QC	Quality Assurance/Quality Control
QAPP	Quality Assurance Project Plan
QC	Quality Control
QL	Quantitation Limit
QMP	Quality Management Plan
RA	Risk Assessment
RI	Remedial Investigation
RI/FS	Remedial Investigation/Feasibility Study
RL	Reporting Limit
RM	River Mile
RPD	Relative Percent Difference
RPM	Remedial Project Manager
RSD	Relative Standard Deviation
RTC	Resource Technology Corporation
S/N	Signal to Noise
SDG	Sample Delivery Group
SDS	Soxhlet/Dean Stark
SM	Standard Method
SOP	Standard Operating Procedure
SOW	Statement of Work
SSC	Suspended Sediment Concentration
SSO	Site Safety Officer
SSP	Supplemental Sampling Program
SV	Small Volume
SVCG	Small Volume Composite Grab
SVOC	Semivolatile Organic Compounds
SWO	Stormwater Outfall
TC	Technical Committee
TCDD	Tetrachlorodibenzo-p-dioxin
TCDF	Tetrachlorodibenzofuran
TOC	Total Organic Carbon
TSA	Technical Surveillance Audit
TSS	Total Suspended Solids
UFP	Uniform Federal Policy
USACE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency

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USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
VOCs	Volatile Organic Compounds
WCM	Water Column Monitoring
WP	Water Pollution
WS	Water Supply

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## Introduction

This Quality Assurance Project Plan (QAPP) describes the sample collection and analysis of the high volume (HV) chemical portion of the Water Column Monitoring (WCM) program of the Remedial Investigation (RI) as outlined in the Lower Passaic River Restoration Project (LPRRP) Field Sampling Plan (FSP), Volume 1 (Malcolm Pirnie, Inc. (MPI) 2006a). The RI is required by the Administrative Settlement Agreement and Order on Consent for Remedial Investigation/Feasibility Study (RI/FS) (Settlement Agreement [USEPA 2007a] and its Appendix B (i.e., Statement of Work [SOW])). The Cooperating Parties Group (CPG) has entered into the Settlement Agreement (USEPA 2007a) to perform the RI. This document uses applicable worksheets from the United States Environmental Protection Agency (USEPA) Uniform Federal Policy (UFP) on QAPPs [Publication Numbers: EPA: EPA-505-B-04-900A DoD: DTIC ADA 427785] (USEPA 2005). This document includes the QAPP and two appendices; Appendix A contains the field standard operating procedures (SOPs) and Appendix B contains the laboratory SOPs.

The WCM program has been divided into two major tasks. The first task, the WCM/Physical Data Collection or Physical WCM (PWCM) program, included collection of physical measurements in the water column (currents, temperature, conductivity, turbidity, organic carbon and solids). This task was performed under the *Quality Assurance Project Plan/Field Sampling Plan Addendum, Remedial Investigation Water Column Monitoring/Physical Data Collection for the Lower Passaic River, Newark Bay and Wet Weather Monitoring, Lower Passaic River Restoration Project* (AECOM 2010a). The second task, WCM/Chemical Data Collection or Chemical Water Column Monitoring (CWCM) includes collection of small and high volume (HV) water column samples for chemical analysis. The work covered under the small volume (SV) CWCM QAPP (AECOM, 2011a) is ongoing. The HV portion of the CWCM data collection is described in this QAPP. The information collected with respect to the physical characteristics of the Lower Passaic River (LPR) and Newark Bay (NB), and the SV QAPP, has been used to aid in the development of the QAPP for this phase of the CWCM program (HV CWCM QAPP).

The WCM program includes two distinct study areas; the Lower Passaic River Study Area (LPRSA) (defined as river miles [RM] 0 – 17.4 of the LPR, above Dundee Dam, the Second, Third and Saddle Rivers) and the Newark Bay Study Area (NBSA) (Newark Bay, the Hackensack River, Kill van Kull and the Arthur Kill). Tierra Solutions, Inc. (Tierra) is the respondent for the NBSA. The WCM program includes data collection to support the chemical fate and transport (CFT) model that is being developed for both the LPRSA RI and Feasibility Study (FS) and the NBSA RI/FS.

The proposed HV work includes the collection of large volumes of water (i.e., hundreds of liters [L]) for analysis of the target hydrophobic organic chemical (HOC) analytes on suspended solids and dissolved in water, and collection of whole water for analysis of physical and chemical parameters used to help interpret the HOC data. The resulting data will be used to estimate sorption partition coefficients under a range of salinity conditions. The analytes to be measured have been assigned to one of two groups:

Group A – This group includes polychlorinated biphenyl (PCB) congeners and homologs and polychlorinated dibenzo-p-dioxins (PCDD) and polychlorinated dibenzofurans (PCDF) congeners and homologs, hereafter referred to as PCDD/Fs. The particulate and dissolved fractions will be measured. The specific compounds to be analyzed and reported in Group A are listed in Worksheet #15.

Group B – This group includes suspended sediment concentration (SSC), dissolved organic carbon (DOC) and particulate organic carbon (POC). These parameters will be used to support partition

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coefficient calculations for use in the CFT model and will be measured in a subsample of whole water collected continuously during the entire duration of the HV sampling.

Laboratory analysis of Group A and B analytes will be conducted for all samples. Salinity, temperature, specific conductivity, dissolved oxygen, and pH will be recorded during surface to near-bottom water column profiling (SOP LPR-FI-05) and during the sampling (SOP SW-19). Additional data, including but not limited to flow rates, meteorological data, tidal cycle, and water depth will also be recorded (refer to Worksheet #11 and SOP LPR-G-01 for the complete list).

HV water samples will initially be collected during one planned sampling event when flows at Dundee Dam are between 400 and 3,000 cubic feet per second (cfs) and the results will be evaluated to determine if additional rounds are warranted. The flow thresholds for the HV sampling are consistent with the Routine Events described in the SV QAPP (AECOM, 2011a).

The water column chemical and physical data collection activities are important components of the LPRSA RI/FS and the NBSA RI/FS, which include characterizing the fate and transport of contaminants within the river, assessing risks to human health and ecological receptors, calibrating and validating the LPRSA/NBSA CFT model and assessing the feasibility of remedial alternatives. The HV program will serve primarily to support the development of partition coefficients for the CFT model; but the data will also serve to provide information on the boundary conditions and the dissolved and particulate phase concentrations of certain compounds. The specific data uses for the HV CWCM program are provided in Worksheet #11.

Samples will be collected from six locations in the study area (Figure 1):

- Above Dundee Dam
- RM10.2
- RM 4.2 when flows >1,000 cfs at Dundee Dam/Tidal 2 when flows are <1,000 cfs at Dundee Dam
- NB Northeast
- Kill van Kull
- NB South

From each location, four samples will be collected: one sample of solids separated from the water column to be analyzed for PCBs (congeners and homologs) and PCDD/Fs; one sample of a primary sorption medium (polyurethane foam [PUF]) through which the filtrate has been passed (representative of the dissolved fraction) to be analyzed for PCBs and PCDD/Fs; one sample of a secondary PUF through which the filtrate has been passed to check on HOC breakthrough and ensure more complete HOC quantification; and four time-weighted composite samples of whole water for analyses of POC, DOC and SSC. The primary and secondary sorption media samples will be analyzed and reported separately, and a calculated sum will be included in the EDD. The HOC mass present in the filtered water will be considered to be the sum of the two results. The POC, DOC and SSC samples will be collected from a 20L carboy, calibrated to fill simultaneously with the collection of PCDD/F and PCB samples. These four samples will be analyzed separately by the laboratory and the results averaged for estimation of SSC, DOC and POC for each HV sample. Details are presented in Worksheets #11 and #37.

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The samples will be sent to the laboratory for rapid analysis and turnaround (i.e., 30-day). Upon receipt of the unvalidated data from the laboratory, USEPA, CPG and Tierra will review the data to determine if the HV program has achieved the Project Quality Objectives (PQOs) defined in Worksheet #11. The CPG and Tierra will provide USEPA opinions regarding the potential need to repeat and/or modify the HV program. USEPA will make the final determination.

### **Environmental History and Setting**

The LPRSA and NBSA have been highly modified to accommodate urbanization. Changes in the LPR, NB, and the associated watershed that accompanied European settlement and industrialization of the area to the present day are well chronicled (Iannuzzi et al. 2002). Most of the tidal marsh, mudflats, shallow nearshore areas, and tidal wetlands historically present in the LPRSA and NBSA have been either filled or dredged. Today, the majority of the shoreline in the LPR consists of riprap and sheet pile walls resulting in a highly channelized river. Upper portions of the LPR feature generally steeper and less modified shorelines with limited areas of riparian vegetation.

### **History of the LPR and NB**

More than 200 years of industrialization and urbanization have had a substantial effect on the LPR watershed and NB, which were an important location for industry during the American Industrial Revolution (MPI 2007a). These early industries, as well as other industries that developed during the 19th and early 20th centuries, used the LPR and NB for process water and waste disposal, which adversely affected water and sediment quality (Iannuzzi and Ludwig 2004). In addition, overall sediment and water quality is impaired as a result of historical direct municipal discharges, historical and continuing surface runoff, and municipal combined sewer overflows (CSOs) and stormwater outfalls (SWOs). These impacts to general water quality were reduced in 1970 when the Clean Water Act was passed (Iannuzzi and Ludwig 2004).

In 1858, the Dundee Dam and associated locks were constructed on the LPR. After the completion of the dam, mills were built along the upper LPR near the City of Passaic (Iannuzzi et al. 2002). Above Dundee Dam, the City of Paterson was a significant center of industrialization and manufacturing beginning in the late 18th Century. In the early 20th Century, Newark, New Jersey, became one of the largest industrial cities in the United States. Industries included petroleum refineries, shipping facilities, tanneries, and various manufacturers (Battelle 2005).

Approximately 88 percent of the wetlands near the LPR and NB were lost after 1816 (Iannuzzi et al. 2002). These wetland areas were ditched, diked, drained, and covered with fill material for various purposes including: salt hay production, gardens and dairies, railroad beds, oil storage/refining, shipyards and shipping ports, mosquito control, municipal and industrial waste disposal, and airport development (Iannuzzi et al. 2002). Dredging in the LPR began in 1874 and continued until 1983, but only maintenance dredging occurred after 1940 (Iannuzzi and Ludwig 2004; MPI 2007a). The dredging allowed for commercial shipping and for deeper-draft ships to dock in the lower section of the LPR. In NB, dredging began in 1860, and between 1891 and 1934, a series of federal navigation channels and the large marine terminal at Port Newark were constructed. The dredge materials were used as fill at Port Newark and along the eastern shoreline to facilitate shoreline development. Maintenance dredging began in 1934 and continues to present day within NB and its tributaries. The latest dredging project, the New York/New Jersey Harbor Deepening Project, includes dredging in Ambrose Channel, Anchorage Channel, Kill van Kull Channel, Newark Bay

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Channels, the Port Jersey Channel, Arthur Kill (to Howland Hook), and Bay Ridge Channel to 50 feet deep in order to allow safe passage of new large container ships. Of these, Newark Bay Channel, Arthur Kill Channel, and Kill van Kull Channel are within the study area for the CWCM program. In addition to the Harbor Deepening Project, navigation channels throughout NB and the LPR are subject to maintenance dredging that may occur periodically, and is dependent on the rate of sediment accumulation.

The LPRSA is an operable unit (OU) of the Diamond Alkali Superfund Site. The NBSA, having been impacted by historical releases of PCDD/Fs and other contaminants due to tidal mixing, is also an OU of the Diamond Alkali Superfund Site. In 1984, the Diamond Alkali Superfund Site was placed on the National Priorities List as a result of past industrial operations at the Diamond Alkali plant (80-120 Lister Avenue in Newark, New Jersey), which resulted in the release of hazardous substances such as PCDDs and pesticides. Sampling of Passaic River sediments conducted during the RI/FS for the Diamond Alkali plant revealed numerous organic and inorganic compounds including, but not limited to, PCDD/Fs, pesticides, PCBs, Polycyclic Aromatic Hydrocarbons (PAHs), and metals. In 1994, an investigation of a 6-mile stretch of the Passaic River centered on the Diamond Alkali plant was begun. Extensive sampling showed that the sediments throughout the 6-mile study area were contaminated with organic and inorganic substances. In 2001, USEPA expanded the scope of the Superfund study to encompass the 17.4-mile stretch of the Passaic River and added a large number of Potential Responsible Parties (PRPs) for historical releases that potentially contributed to the chemicals found in the river.

### Physical Setting of the LPRSA and NBSA

The LPR is a stratified estuary. It receives marine (salt) water from NB and freshwater from the upper Passaic River (above Dundee Dam) and from the tributaries and the CSO/SWOs located below Dundee Dam. The less dense freshwater flows downstream over the tidally influenced salt water that, on the flood tide, moves upstream from NB. The current Conceptual Site Model (CSM) (MPI 2007a) defines the LPR based on three salinity regimes specified by RM:

- Freshwater River Section (RM 10–17.4) is the region usually upstream of the salt front (the salt front rarely extends further upstream than RM 13 and is upstream of RM 10 typically about 10% of the time).
- Transitional River Section (RM 6–10) is characterized by the most frequent location of the salt front with water conditions varying from slightly brackish (or oligohaline, with salinity values ranging from 0.5 parts per thousand [ppt] to 5 ppt) to moderately brackish (or mesohaline, with salinity values ranging from 5 ppt to 18 ppt).
- Brackish River Section (RM 0–6) is located downstream of the typical location of the salt front and is mesohaline, i.e., with salinity values ranging from 5 ppt to 18 ppt.

The location of the salt wedge (i.e., a wedge-shaped intrusion of salt water into the estuary that slopes downward in the upstream direction) is dependent on the phase of the tide and the volume of freshwater flowing downstream. In general, the salt wedge extends further upstream during spring flood tides and low river flow, although the leading edge of the wedge is pushed further downstream during high river flow events, and may intrude into NB during storm events with very high freshwater flows. Salinity measured near RM 10 during the summer of 2005 had maximums between 3 and 6 ppt (MPI 2007b). During the PWCM program deployment (10/11/09 – 7/23/10), the daily maximum bottom water salinity at RM 10.2

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exceeded 2 ppth for about 6 percent of the record and was usually associated with river flows less than 250 cfs (as measured at Little Falls) . The behavior of the salt wedge is currently being characterized by data obtained during the PWCM program in conjunction with the hydrodynamic model.

The LPR is relatively shallow, with thalweg (i.e., deepest point, laterally, across the river) depths ranging from a few feet (upper portions below Dundee Dam) to 30 feet near the mouth. A federally authorized navigation channel exists between the mouth and approximately RM 15.4 (United States Army Corps of Engineers [USACE] 2007). Surficial sediments in the main stem of the LPRSA gradually transition from mostly coarse material (gravel or rock) upstream of RM 12 to mostly fine material (silts and fine sand) downstream of RM 8 (MPI 2006b, AECOM 2010a). Some deviations from this trend are found in lower areas of the LPRSA where steepened shorelines have been armored, in erosional areas associated with bridge abutments, and near river bends.

NB is approximately one mile wide and six miles long. According to USACE (1997), it is naturally shallow , with navigation channels, turning basins and docking facilities encompassing the deepest areas. The eastern side is very shallow with depths ranging from 0.5 to 10 feet below mean low water. Areas south of Kearny Point and the Elizabeth Channel and along the western side above and below Port Newark Channel include other smaller pockets of shallow water.

The Passaic and Hackensack Rivers flow into NB from the north. The National Oceanic and Atmospheric Administration (NOAA) (1984) estimates an annual average of 1,448 cfs of freshwater discharges to NB from the LPR making it the largest contributor of freshwater to NB; an additional 194 cfs of freshwater enters from the Hackensack River. Saltwater enters NB through Arthur Kill and Kill van Kull. Suszkowski (1978) developed a sediment and water budget for NB that indicated the Kill van Kull is the largest contributor of inorganic sediments to NB; combined with Arthur Kill, the exchange provides 64% of inorganic sediments. The LPR and Hackensack River contribute approximately 31% of inorganic sediments. Data collected by Sommerfield and Chant (2010) support that Kill van Kull is the largest contributor of sediments, with approximately 86% (140,000 metric tons per year) of total sediment influx coming from Kill van Kull. The LPR and Hackensack River contribute approximately 14% of influx (22,000 metric tons per year). NB exports approximately 20,000 metric tons per year to the Arthur Kill.

#### **PWCM Data Collection Task**

The PWCM task was performed during two deployments: October – December 2009 (2009 fall deployment) and March - July 2010 (2010 spring/summer deployment). Data were collected to characterize currents and flows, temperature, salinity, and solids in the water column within the LPRSA during the 2009 fall deployment, and both the LPRSA and NBSA during the 2010 spring/summer deployment. A detailed description of the field activities can be found in the PWCM QAPP/FSP Addendum (AECOM 2010a).

The interaction between freshwater and estuarine tidal flows within the LPRSA impacts the fate and transport of sediment and contaminants. High freshwater flows have the potential to wash sediments into the LPR from above Dundee Dam, CSOs, SWOs and the LPRSA tributaries, resuspend the sediments, and transport sediments and constituents bound to those sediments out of the LPRSA and into the NBSA. The magnitude of tidal flows during a high freshwater flow event will impact channel velocities and transport of sediments. During low flows, flood tide moves contaminated sediments into the LPR from NB. Flood tidal velocities that exceed ebb tidal velocities can result in net upstream transport during extended periods of low

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freshwater flows.

Data on the physical characteristics of the LPR have been collected by Tierra, Rutgers University for New Jersey Department of Transportation (NJDOT), and MPI for the USEPA. The primary physical and chemical water column data sets collected during the past 15 years in the LPRSA were reviewed to establish data quality and usability. Attachment 1 of the PWCM QAPP (AECOM 2010a) provides a review of these historic data sets, some examples of the data, a review of data quality, and a summary of their collective ability to address the Data Quality Objectives (DQOs) of the study. These data sets, combined with the data collected by the CPG, were used to feed the sampling design of the program defined in this QAPP.

The PWCM data were reviewed in order to design this HV sampling program. These data, including the location of the salt water wedge under different flow regimes, and the relative and estimated SSC on a temporal and spatial basis, were used to develop the sampling plan.

#### **CWCM Data Collection Task**

LPRSA surface water chemical concentration data have been collected, but these data are much more limited than the physical data collected during the PWCM and are not sufficient to meet the needs of the Lower Passaic River/Newark Bay (LPR/NB) Modeling Program. Data collected by MPI and the New York and New Jersey Harbor Estuary Program (NY/NJ HEP, 2004) are summarized in Worksheet #13 of this QAPP. Data are being collected by the CPG and Tierra under the SV CWCM QAPP (AECOM, 2011a), and this is also presented in Worksheet #13. Although the available data provide some understanding of the concentration of some constituents in the LPR (particularly PCDD/Fs and PCBs), they are not of sufficient quality and quantity to adequately characterize the chemical concentrations in the solid and dissolved phases throughout the LPRSA and NBSA. It is believed that better quality (i.e., with lower detection limits) solid and dissolved phase HOC data will reduce the level of uncertainty in the partition coefficients used in the CFT model for the LPRSA and NBSA.

The chemical data collection sampling plan presented in this document has been developed to address the identified data needs and provide the data necessary to meet the objectives provided in Worksheet #11. The primary objective of the HV CWCM program is to provide the data necessary to develop improved sorption partition coefficients in the LPRSA and NBSA (i.e., using data from a variety of salinity conditions in the LPRSA and NBSA), augmenting those currently used by the CFT model.

Broadly defined, the goals of the HV CWCM Data Collection Program are to:

1. Develop improved sorption partition coefficients for PCDD/Fs and PCBs from areas of lower and higher salinity in the LPRSA and NBSA.
2. Characterize the inputs of PCDD/Fs and PCBs at the boundaries of the LPRSA and NBSA by HV sampling in Kill van Kull and above Dundee Dam.
3. Collect data to characterize the dissolved and particulate phase concentrations of contaminants in surface water from the LPRSA and NBSA.

These goals have been designed to support the ongoing RI site characterization and modeling efforts. The goals are defined in more detail in Worksheet #11 to this document: Project Quality Objectives/Systematic

**Quality Assurance Project Plan**

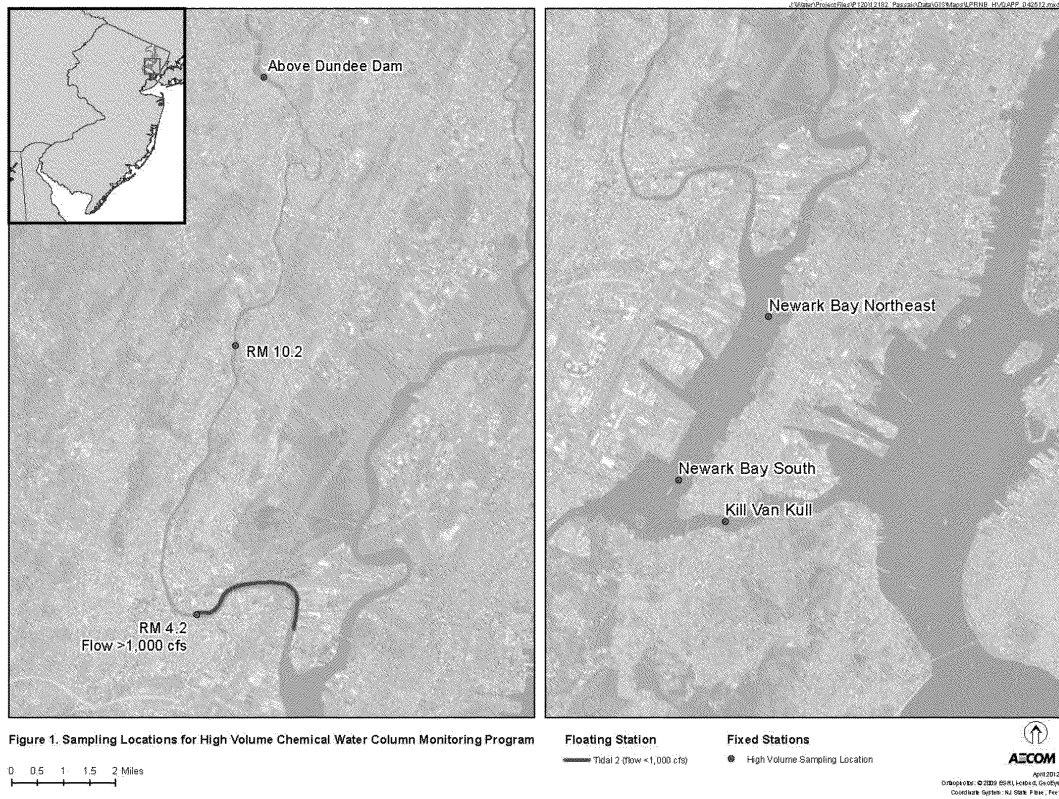
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**Introduction (Continued)**

Planning Process Statements. The PQOs include the DQOs of the project (i.e., what data are needed and how they will be collected).



**Document Title:** Quality Assurance Project Plan. RI Water Column Monitoring/High Volume Chemical Data Collection. Lower Passaic River Restoration Project.

**Lead Organization:** Cooperating Parties Group and de maximis, Inc.

**Preparer's Name and Organizational Affiliation:** Kristen Durocher, AECOM

**Preparer's Address and Telephone Number:**

250 Apollo Dr., Chelmsford, MA 01824  
603-581-6608

**Preparation Date (Day/Month/Year):** Revision 0, June 2012; Revision 1, September 2012

Investigative Organization's Project Manager (PM)

---

Laura Kelmar / AECOM / September 2012

Investigative Organization's Project QA Manager

---

Debra Simmons / AECOM / September 2012

Lead Organization's PM

---

Bill Potter / Robert Law / de maximis, inc. /  
September 2012

**Site Name/Project Name:** Diamond Alkali OU 2 – LPRRP RI/FS

**Site Location:** LPRSA and NBSA, New Jersey  
**Site Number/Code:** CERCLA Document No. 02-2007-2009  
**Operable Unit:** OU 2 (LPRSA) and OU 3 (NBSA)  
**Contractor Name:** AECOM  
**Contractor Number:** Not Applicable (N/A)  
**Contract Title:** N/A  
**Work Assignment Number:** N/A

1. Identify guidance used to prepare QAPP:

Uniform Federal Policy for Quality Assurance Project Plans. Evaluating, Assessing, and Documenting Environmental Data Collection and Use Programs. Part 1: UFP-QAPP Manual. Final Version 1. March 2005. Intergovernmental Data Quality Task Force (USEPA, US Department of Defense [DoD], US Department of Energy). USEPA 505-B-04-900A.

2. Identify regulatory program: Comprehensive Environmental Response Compensation, and Liability Act (CERCLA)

3. Identify approval entity: USEPA Region 2

4. Indicate whether the QAPP is a generic or a project-specific QAPP (circle one)

5. List dates of scoping sessions that were held: December 9, 2009; August 11, 2010; August 20, 2012; January 26, 2012; and March 22, 2012.

6. List dates and titles of QAPP and FSP documents written for previous site work, if applicable:

Title
Chemical Land Holdings (CLH) 1995. <i>Work Plan, Vol. 1 of Passaic River Study Area Remedial Investigation Work Plans</i> . Chemical Land Holdings (now Tierra Solutions, Inc.), Newark, NJ. January 1995.
Tierra Solutions, Inc. 1999. <i>Passaic River Study Area Ecological Sampling Plan. Quality Assurance Project Plan</i> . March 1999.
MPI 2005a. <i>Lower Passaic River Restoration Project. Work Plan</i> . Prepared for US Environmental Protection Agency and US Army Corps of Engineers. Malcolm Pirnie, Inc., White Plains, NY.
MPI 2005b. <i>Lower Passaic River Restoration Project. Revised Preliminary Draft Field Sampling Plan. Volume 3</i> . Prepared for US Environmental Protection Agency and US Army Corps of Engineers. Malcolm Pirnie, Inc., White Plains, NY.
MPI 2005c. <i>Lower Passaic River Restoration Project. Quality Assurance Project Plan</i> . Prepared for US Environmental Protection Agency and US Army Corps of Engineers. MPI, White Plains, NY.
MPI 2006a. <i>Lower Passaic River Restoration Project. Field Sampling Plan. Volume 1</i> . Prepared for US Environmental Protection Agency, US Army Corps of Engineers. MPI, White Plains, NY.
MPI 2006b. <i>Lower Passaic River Restoration Project. Field Sampling Plan. Volume 2</i> . Prepared for US Environmental Protection Agency, US Army Corps of Engineers. Malcolm Pirnie, Inc., White Plains, NY.
MPI 2007c. <i>QAPP/FSP Addendum for Lower Passaic River Restoration Project Empirical Mass Balance Evaluation</i> . December 2007.
ENSR 2008. <i>Lower Passaic River Restoration Project RI/FS. Quality Assurance Project Plan. RI Low Resolution Coring/Sediment Sampling. Revision 4</i> . ENSR, Westford, MA. October 2008.
AECOM 2008. <i>Lower Passaic River Restoration Project. Bathymetric Surveys. Quality Assurance Project Plan</i> . AECOM, Westford, MA. October 2008.

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Windward 2009a. <i>Lower Passaic River Restoration Project. Lower Passaic River Study Area RI/FS. Quality Assurance Project Plan: Fish and Decapod Crustacean Tissue Collection for Chemical Analysis and Fish Community Survey.</i> Final. Prepared for Cooperating Parties Group, Newark, New Jersey. Windward Environmental LLC, Seattle, WA. August 2009.
Windward 2009b. <i>Lower Passaic River Restoration Project. Lower Passaic River Study Area RI/FS. Quality Assurance Project Plan: Surface Sediment Chemical Analyses and Benthic Invertebrate Toxicity and Bioaccumulation Testing.</i> Final. Prepared for Cooperating Parties Group, Newark, New Jersey. October 8, 2009. Windward Environmental LLC, Seattle, WA. October 2009.
AECOM 2010a. <i>Quality Assurance Project Plan/Field Sampling Plan Addendum. Remedial Investigation Water Column Monitoring/Physical Data Collection for the Lower Passaic River, Newark Bay and Wet Weather Monitoring. Lower Passaic River Restoration Project.</i> Revision 4. AECOM, Westford, MA. March 2010.
Tierra Solutions, Inc. 2011. <i>Combined Sewer Overflow/Stormwater Outfall Investigation Quality Assurance Project Plan. Lower Passaic River Study Area.</i> Revision 0. May 25, 2011.
AECOM, 2011a. <i>Quality Assurance Project Plan/ Field Sampling Plan Addendum. RI Water Column Monitoring/Small Volume Chemical Data Collection. Lower Passaic River Restoration Project.</i> Revision 2. AECOM, Chelmsford, MA. August 2011.
AECOM 2011b. <i>Quality Assurance Project Plan. Lower Passaic River Study Area. River Mile 10.9 Characterization.</i> Revision 3. AECOM, Chelmsford, MA. October 2011.
AECOM, 2012. <i>Quality Assurance Project Plan. Lower Passaic River Study Area. Low Resolution Coring Supplemental Sampling Program. Lower Passaic River Restoration Project.</i> Revision 2. AECOM, Chelmsford, MA. January 2012.

7. List organizational partners (stakeholders) and connection with lead organization:

This work will be performed under the requirements of the Settlement Agreement and SOW with oversight conducted by USEPA and its government partners. de maximis, Inc. (acting as Project Coordinator for the CPG), AECOM, and its subcontractors, are conducting the work on behalf of the CPG.

8. List data users: See item #7 above.

9. If any required QAPP elements and required information are not applicable to the project, then circle the omitted QAPP elements and required information on the attached table.  
Provide an explanation for their exclusion below: N/A

Required QAPP Element(s) and Corresponding QAPP Section(s)	Required Information	Crosswalk to QAPP Worksheet No. or Related Documents
<b>Project Management and Objectives</b>		
2.1 Title and Approval Page	- Title and Approval Page	1

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<b>Assessment/Oversight</b>		

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5.2.3.2 Activities		
5.3 Streamlining Data Review	To be completed following data evaluation	NA
5.3.1 Data Review Steps To Be Streamlined		
5.3.2 Criteria for Streamlining Data Review		
5.3.3 Amounts and Types of Data Appropriate for Streamlining		

The following persons will receive a copy of the approved Final QAPP, subsequent QAPP revisions, addenda, and amendments:

QAPP Recipients	Title	Organization	Telephone Number	E-mail Address	Document Control Number*
Stephanie Vaughn	LPRSA Remedial Project Manager (RPM)	USEPA Region 2	212.637.3914	<a href="mailto:vaughn.stephanie@epa.gov">vaughn.stephanie@epa.gov</a>	
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Eugenia Naranjo	NBSA RPM	USEPA Region 2	212.637.3467	<a href="mailto:naranjo.eugenia@epa.gov">naranjo.eugenia@epa.gov</a>	
Lisa Baron	PM	USACE-NY District	917.790.8306	<a href="mailto:Lisa.A.Baron@usace.army.mil">Lisa.A.Baron@usace.army.mil</a>	
Janine MacGregor	Project Coordinator	New Jersey Department of Environmental Protection (NJDEP)	609.633.0784	<a href="mailto:Janine.MacGregor@dep.state.nj.us">Janine.MacGregor@dep.state.nj.us</a>	
Tim Kubiak	Assistant Supervisor of Environmental Contaminants	United States Fish and Wildlife Service (USFWS)	609.646.9310 (ext. 26)	<a href="mailto:tim_kubiak@fws.gov">tim_kubiak@fws.gov</a>	
Reyhan Mehran	Coastal Resource Coordinator	NOAA	212.637.3257	<a href="mailto:reyhan.mehran@noaa.gov">reyhan.mehran@noaa.gov</a>	
Robert Law Bill Potter (alternate)	CPG Project Coordinator	de maximis, Inc.	908.735.9315	<a href="mailto:rlaw@demaximis.com">rlaw@demaximis.com</a> <a href="mailto:otto@demaximis.com">otto@demaximis.com</a>	
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Don Kretchmer	Field Task Manager (FTM)/Site Safety Officer (SSO)	AECOM	603.387.0532	<a href="mailto:Don.Kretchmer@aecom.com">Don.Kretchmer@aecom.com</a>	
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James Herberich	Data Management Task Manager	AECOM	978.905.2243	<a href="mailto:Jim.Herberich@aecom.com">Jim.Herberich@aecom.com</a>	



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### QAPP Worksheet #3 (UFP-QAPP Manual Section 2.3.1) Distribution List

Lisa Krowitz	Data Validation Coordinator	AECOM	978.905.2278	<a href="mailto:Lisa.Krowitz@aecom.com">Lisa.Krowitz@aecom.com</a>	
Betsy Ruffle	Human Health Risk Assessment (HHRA) Task Leader	AECOM	978.905.2377	<a href="mailto:Betsy.Ruffle@aecom.com">Betsy.Ruffle@aecom.com</a>	
Rafael Canizares	Modeling Team Task Leader and Liaison	Moffatt & Nichol	212.768.7454	<a href="mailto:rcanizares@moffattnichol.com">rcanizares@moffattnichol.com</a>	
Shawn Hinz	HV Sampling Technician	Gravity Environmental	425.281.1471	<a href="mailto:shawn@gravityenv.com">shawn@gravityenv.com</a>	
Ken Cadmus	Vessel Subcontractor Lead	Ocean Surveys, Inc. (OSI)	860.388.4631	<a href="mailto:kac@oceansurveys.com">kac@oceansurveys.com</a>	
Stella Cuenco	Senior Chemist/Assistant Operations Manager	Laboratory Data Consultants, Inc. (LDC)	760.634.0437	<a href="mailto:scuenco@lab-data.com">scuenco@lab-data.com</a>	
Patrick Connelly George Molnar	USEPA Oversight Contractor	CDM	814.659.4603 908.420.8208	<a href="mailto:connellypc@cdm.com">connellypc@cdm.com</a> <a href="mailto:MolnarGC@cdm.com">MolnarGC@cdm.com</a>	

\*Uncontrolled electronic copies will be available on [www.ourpassaic.org](http://www.ourpassaic.org)

**Organization:** A completed sign-off sheet will be maintained in the files for each organization represented below.

\*Signature indicates that personnel have read the applicable QAPP sections and will perform the tasks as described.

Project Personnel	Title	Telephone Number	Signature*	Date QAPP Read
Robert Law /Bill Potter	CPG Project Coordinator	908.735.9315		
Polly Newbold	CPG QA Coordinator	908.479.1975		
Laura Kelmar	AECOM PM	978.905.2266		
Kristen Durocher	AECOM Task Manager	603.581.6608		
Don Kretchmer	AECOM FTM/SSO	603.387.0532		
Debra Simmons	AECOM Project QA Manager	978.905.2399		
Robert Shoemaker	AECOM Project Chemist	978.905.2393		
Robert Kennedy (alternate)	AECOM Project Chemist	978.905.2269		
James Herberich	AECOM Data Management Task Manager	978.905.2243		
Lisa Krowitz	AECOM Data Validation Coordinator	978.905.2278		
Shawn Hinz	HV Sampling Technician	425.281.1471		
Ken Cadmus	OSI Vessel Subcontractor Lead	860.388.4631		
Heather Steele	Analytical Perspectives PM	910.794.1613		
Lynda Huckestein	Columbia Analytical Services, Inc. (CAS) PM	360.501.3358		
Stella Cuenco	Senior Chemist/Assistant Operations Manager LDC	760.634.0437		

\*Signature indicates that personnel have read the applicable QAPP sections and will perform the tasks as described.



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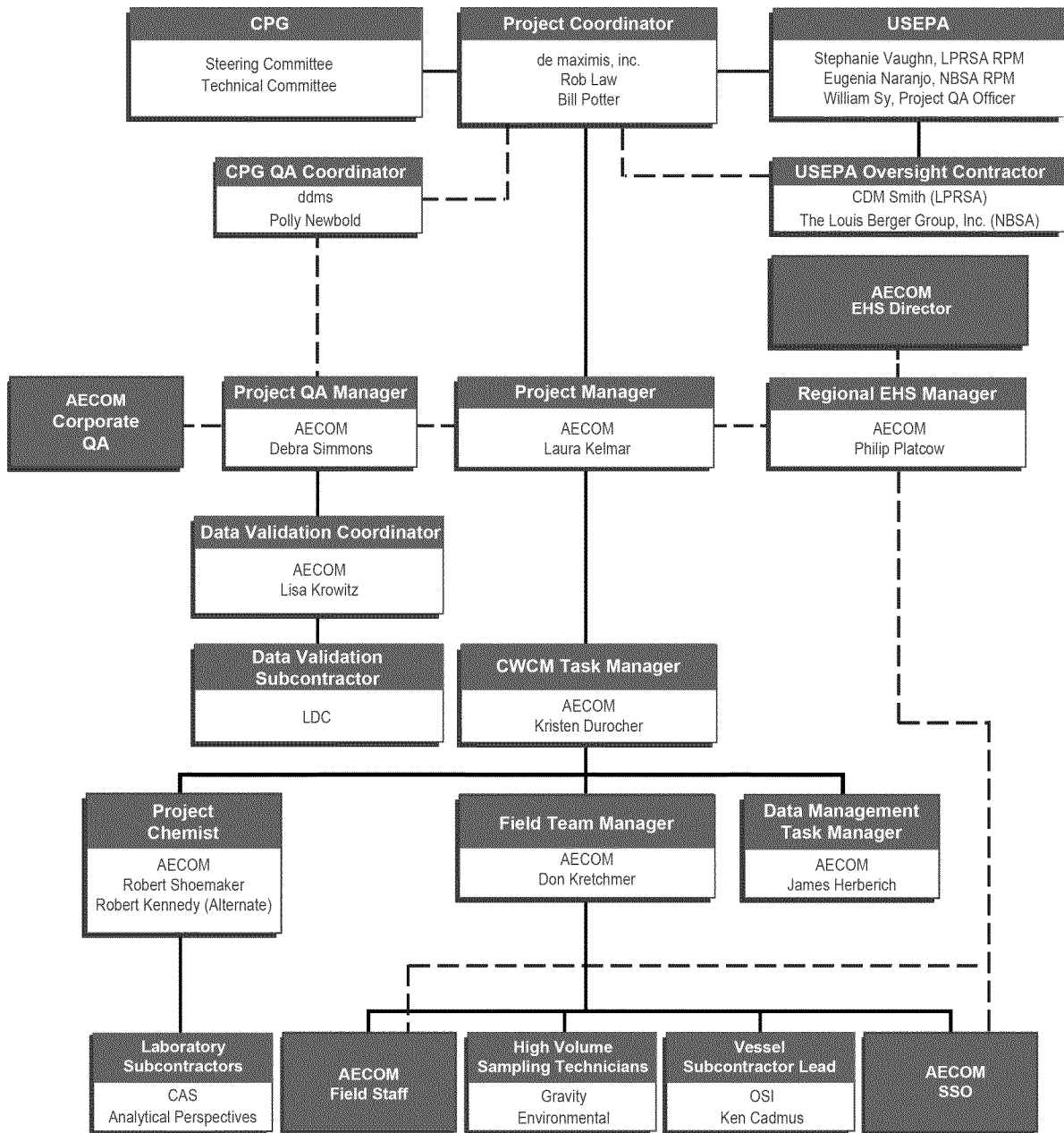
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### QAPP Worksheet #4 (UFP-QAPP Manual Section 2.3.2) Project Personnel Sign-Off Sheet

#### Organization:

Project Personnel	Title	Telephone Number	Signature*	Date QAPP Read

\*Signature indicates that personnel have read the applicable QAPP sections and will perform the tasks as described.



M12014

<b>Communication Drivers</b>	<b>Responsible Entity</b>	<b>Name</b>	<b>Phone Number</b>	<b>Procedure (timing, pathways, etc.)</b>
Field activities status and issues	AECOM FTM	Don Kretchmer	603.387.0532	Communicate daily, or as needed, with AECOM field personnel, subcontractors, and AECOM Task Manager directly, or via e-mail or phone. Minor work plan deviations and/or proposed revisions will be documented and communicated in writing, with a copy sent to USEPA. Coordination of USEPA oversight activities and reporting of oversight activities to the AECOM Task Manager.
Sampling progress/laboratory coordination	AECOM Task Manager	Kristen Durocher	603.581.6608	Communicate daily, or as needed, with AECOM FTM and Project Chemist via e-mail or phone. Scheduling of USEPA oversight activities.
Health and safety (H&S) briefings and updates	AECOM SSO	Don Kretchmer	603.387.0532	Communicate daily, or as needed, with field personnel and boat operators directly, or via e-mail or phone.
Significant H&S concerns or incidents	AECOM SSO	Don Kretchmer	603.387.0532	Communicate immediately with AECOM Regional EHS Manager, AECOM Task Manager, and AECOM PM.
Sampling vessel operations	Sampling Vessel Captain	To be determined OSI	860.388.4631	Communicate daily, or as needed, with AECOM FTM directly. The sampling vessel captain has the ultimate authority for stopping work while working on water. The vessel captain, in consultation with the SSO, will follow guidelines documented in the site-specific Health and Safety Plan (HASP). In addition, standard safe boating practices related to weather conditions and vessel operations will apply, even if not specifically addressed in the HASP.
Analytical laboratory issues, including coordination with field, schedule, and technical issues	AECOM Project Chemist	Robert Shoemaker Robert Kennedy (alternate)	978.905.2393 978.905.2269	Communicate with AECOM FTM and Laboratory PM as needed via phone or e-mail.
Analytical data validation issues	AECOM Data Validation Coordinator	Lisa Krowitz	978.905.2278	Communicate with Laboratory PM and validation subcontractor as needed via phone or e-mail.



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Audit findings (field and/or laboratory)	AECOM Project QA Manager	Debra Simmons	978.905.2399	Communicate findings to AECOM Task Manager or Laboratory PM (as appropriate); transmit final audit reports, including CA, to AECOM PM, AECOM Task Manager, CPG QA Coordinator, and USEPA RPMs.
Issues potentially affecting DQOs	AECOM FTM	Don Kretchmer	603.387.0532	Communicate as needed with AECOM QA Manager and AECOM Task Manager via e-mail or phone.
	OSI Vessel Subcontractor Lead	Ken Cadmus	860.388.4631	
	AECOM Project Chemist	Robert Shoemaker Robert Kennedy (alternate)	978.905.2393 978.905.2269	
	AECOM Data Validation Coordinator	Lisa Krowitz	978.905.2278	
	AECOM Task Manager	Kristen Durocher	603.581.6608	Communicate with AECOM QA Manager and AECOM PM as needed, via e-mail or phone. Notification of the CPG Project Coordinator as appropriate. Significant work plan modifications will be reported to USEPA in writing prior to implementation.
Sample collection task implementation, including sampling, analysis, and reporting	AECOM FTM	Don Kretchmer	603.387.0532	Communicate with AECOM Task Manager as needed, via e-mail or phone.
Project status and issues (internal)	AECOM PM	Laura Kelmar	978.905.2266	Communicate with CPG Project Coordinator daily, or as needed, via e-mail or phone, and submit monthly progress reports.



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Project status and issues (external)	CPG Project Coordinator	Robert Law/ Bill Potter (de maximis, inc.) Mike Barbara (mab Consulting, LLC)	908.735.9315	Communicate with USEPA RPM as needed via e-mail or phone.
	CPG Coordinating Counsel	William Hyatt / Dawn Monsen (K&L Gates)	973.848.4045 or 4148	In the event the CPG Project Coordinator is unavailable for communication with USEPA, the AECOM PM will notify the Coordinating Counsel prior to contacting USEPA.
Quality status and issues	CPG QA Coordinator	Polly Newbold	908.479.1975	Communicate with CPG Project Coordinator as needed via e-mail or telephone
Data management	AECOM FTM	Don Kretchmer	603.387.0532	Communicate with the Data Management Task Manager via e-mail; transmit final field locations and sample collection information daily.
	AECOM Data Management Task Leader	Jim Herberich	978.905.2243	Maintain comprehensive project technical database, communicate with AECOM FTM to receive data from the field; communicate with Laboratory PM(s) to receive analytical result data, communicate with AECOM Data Validation Coordinator to facilitate validation review and database update; communicate with AECOM Task Manager to provide data for review; and provide data deliverables to USEPA.
	Laboratory PM	See Worksheet #30	See Worksheet #30	Transmit Electronic Data Deliverables (EDDs) to Data Management Task Manager.
	AECOM Data Validation Coordinator	Lisa Krowitz	978.905.2278	Communicate with Data Management Task Manager regarding final data qualifiers.



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### ***QAPP Worksheet #6 (UFP-QAPP Manual Section 2.4.2) Communication Pathways***

Stop Work (technical non-compliance)	AECOM Field team, Project QA Manager, Project Chemists, and Data Management Task Manager			Any personnel believing that a work stoppage is necessary shall first verbally notify the AECOM Task Manager or the AECOM PM, who will in turn verbally notify de maximis, inc. and/or AECOM Project QA Manager, if necessary. Given the potential significance of such communications, this will occur as quickly as possible.
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<b>Name</b>	<b>Title</b>	<b>Organizational Affiliation</b>	<b>Responsibilities</b>	<b>Education and Experience Qualifications</b>
Robert Law	CPG Project Coordinator (Lead)	de maximis, Inc.	Overall responsibility for the safe and proper execution of task. Be available to discuss and review technical and other issues that may arise during work. Periodically review and audit work to ensure that work plan, project quality assurance/quality control (QA/QC), and H&S including both boating and hazardous materials worker safety procedures are being followed. All deviations from approved project plans will be discussed with and approved by the CPG Project Coordinator. Primary point of contact with the USEPA, its oversight contractor and the LPRSA and NBSA Partner Agencies. The Partner Agencies include USACE, NJDOT, NOAA, and USFWS.	PhD, Geology, 30 years experience
Willard Potter	CPG Project Coordinator (Alternate)	de maximis, Inc.	Serves as back up for the Lead CPG Project Coordinator. Responsible for the safe and proper execution of task. Be available to discuss and review technical and other issues that may arise during work. Periodically review and audit work to ensure that work plan, project QA/QC, and EHS including both boating and hazardous materials worker safety procedures are being followed. All deviations from approved project plans will be discussed with and approved by the CPG Project Coordinator. Primary point of contact with the USEPA, its oversight contractor and the LPRSA Partner Agencies.	BS, Chemical Engineering, 40 years experience
Mike Barbara, PE	Principal	mab consulting LLC	Project oversight and coordination with the CPG Coordinator.	ME, Environmental Engineering, BE, Civil Engineering, 37 years experience
Laura Kelmar	AECOM PM	AECOM	Overall responsibility for completion of RI tasks in accordance with SOW requirements including technical, financial, and scheduling. Primary point of contact for AECOM with CPG Project Coordinator.	BS, Chemical Engineering, MS, Environmental Engineering, 24 years experience



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### QAPP Worksheet #7 (UFP-QAPP Manual Section 2.4.3) Personnel Responsibilities and Qualification Table

Kristen Durocher	CWCM Task Manager	AECOM	Responsible for the execution and completion of the CWCM program, including procurement of subcontractors, review of task deliverables, and serving as the focus for coordination of all field and laboratory tasks. The CWCM Task Manager will keep the AECOM PM apprised of the status of the task, as well communicate any issues with the schedule, budget, or achievement of the task objectives.	BA, Environmental Studies and Northern Studies, 22 years experience
Don Kretchmer (or designee)	FTM/SSO	AECOM	Responsible for implementing field sampling activities in accordance with the approved plans (QAPP and HASP). Primary responsibilities include directing activities on site, monitoring subcontractor performance in the field, reviewing field records, and communicating daily with the AECOM CWCM Task Manager regarding status, quality, issues, or delays.	BS, Natural Resources, MS Water Resource Management, 30 years experience
Shawn Hinz	HV Sampling Technician	Gravity Environmental	Responsible for operating the HV sampling equipment in accordance with the QAPP and HASP. Primary responsibilities include operation of sampling equipment, data recording and reporting, and daily communication with the AECOM CWCM FTM regarding status, quality, issues, or delays.	MA, Environmental Toxicology, 20 years experience
Debra Simmons	Project QA Manager	AECOM	Responsible for reviewing and approving QA procedures, ensuring that planned QA assessments (e.g., technical surveillance audits [TSA], data validation) are conducted according to the QAPP and the AECOM Quality Management Plan (QMP) (AECOM 2009) and reporting on the adequacy of the QA Program to the AECOM PM.	BS, Biology, 32 years experience



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### QAPP Worksheet #7 (UFP-QAPP Manual Section 2.4.3) Personnel Responsibilities and Qualification Table

Philip Platcow	Regional EHS Manager	AECOM	Responsible for ensuring that the objectives of AECOM's Health and Safety Program are met and for monitoring task activities for conformance to the HASP.	MS, Industrial Hygiene, 27 years experience
Don Kretchmer (or designee)	SSO	AECOM	Responsible for monitoring subcontractor/field team performance in the field and communicating daily with the AECOM FTM, CWCM Task Manager or Regional EHS Manager, as appropriate, regarding H&S, etc. Will ensure that the objectives of the project's H&S Program are met.	BS Natural Resources, MS Water Resource Management, 30 years experience
Robert Shoemaker	Project Chemist (Lead)	AECOM	Responsible for laboratory procurement and monitoring of progress and will be the primary point of contact with the laboratory(ies). The Project Chemist will also be responsible for communicating any issues that could affect achievement of the DQOs to the AECOM CWCM Task Manager and the AECOM Project QA Manager.	BA, Biology and Environmental Science, 17 years experience
Robert Kennedy	Project Chemist (Alternate)	AECOM	Responsible for providing additional technical resources and serves as a back up to the Lead Project Chemist.	BA, Chemistry, 33 years experience
Lisa Krowitz	Data Validation Coordinator	AECOM	Responsible for managing the validation task, including ensuring that validation is conducted and documented according to the requirements of this QAPP, and interacting with the laboratories and validation subcontractor to resolve any issues.	MS, Environmental Science, 28 years experience
James Herberich	Data Management Task Manager	AECOM	Responsible for data management for project, including overall responsibility for database quality and structure, including graphical representation of data.	BA, Engineering Sciences, 26 years experience



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### ***QAPP Worksheet #7 (UFP-QAPP Manual Section 2.4.3) Personnel Responsibilities and Qualification Table***

Polly Newbold	CPG QA Coordinator	ddms, Inc.	Provides oversight of project QA/QC. Periodically review and audit operations to ensure that QAPP QA/QC procedures are being followed.	BS, Textile Science, 30 years experience
Ken Cadmus	Vessel Subcontractor Lead	OSI	Responsible for vessel operation, providing crew and equipment. Acts as the primary point of contact between AECOM FTM and AECOM Task Manager and vessel crew.	MS, Civil Engineering, 20 years experience
Lynda Huckestein	Laboratory PM	CAS	Acts as the primary point of contact at CAS facilities for the AECOM Project Chemist to communicate and resolve sampling, receipt, analysis, and storage issues. Coordinates communication for all CAS network laboratories.	BS, Microbiology, 26 years experience
Heather Steele	Laboratory PM	Analytical Perspectives	Acts as the primary point of contact at Analytical Perspectives for the AECOM Project Chemist to communicate and resolve sampling, receipt, analysis, and storage issues.	BA, Chemistry, BS, Aquatic Biology, 28 years experience

<b>Project Function</b>	<b>Specialized Training by Title or Description of Course</b>	<b>Training Provider</b>	<b>Training Date</b>	<b>Personnel/Groups Receiving Training</b>	<b>Personnel Titles/ Organizational Affiliation</b>	<b>Location of Training Records/ Certificates</b>
FTM/SSO	40 hour (hr)Hazardous Waste Operations and Emergency Response (HAZWOPER)	Compliance Solutions	July 2011	Don Kretchmer	FTM/SSO/AECOM	AECOM
Field Personnel	40 hr HAZWOPER	AECOM	Various	Various	Various/AECOM	AECOM
	HAZWOPER 8-hr Refresher	AECOM	within 12 months			
	Hazmat awareness	AECOM	Various			
Sampling Vessel Captain	40 hr HAZWOPER	Varies	Various	Various Captains	OSI	OSI
	HAZWOPER 8-hr Refresher	Varies	within 12 months			
	U.S. Coast Guard license	U.S. Coast Guard	Various			
	First Aid/Cardiopulmonary Resuscitation (CPR)	Varies	within 24 months			

<b>Project Name: RI Water Column Monitoring/SV Chemical Data Collection</b>			<b>Site Name : Diamond Alkali OU 2 - LPRRP RI/FS</b>	
<b>Projected Date(s) of Sampling: October 2010</b>			<b>Site Location : LPRSA</b>	
<b>Project Manager: Bill Potter/ Robert Law</b>				
<b>Date of Session: December 9, 2009</b>				
<b>Scoping Session Purpose: Discussion among de maximis, inc./ AECOM/Windward/Moffatt &amp; Nichol for DQOs and Data Use Objectives (DUOs) 2010 CWCM program.</b>				
<b>Name</b>	<b>Affiliation</b>	<b>Phone #</b>	<b>E-mail Address</b>	<b>Project Role</b>
Robert Law	de maximis	908.735.9315	<a href="mailto:rlaw@demaximis.com">rlaw@demaximis.com</a>	CPG Project Coordinator
Bill Lee	de maximis	908.735.9315	<a href="mailto:wjlee@demaximis.com">wjlee@demaximis.com</a>	CPG Project Coordinator
Kristen Durocher	AECOM	603.528.8916	<a href="mailto:kristen.durocher.@aecom.com">kristen.durocher.@aecom.com</a>	CWCM Task Manager
Doug Bright	AECOM	250.475.6355	<a href="mailto:Doug.bright@aecom.com">Doug.bright@aecom.com</a>	AECOM planning team
Robert Kennedy	AECOM	978.589.3343	<a href="mailto:Robert.kennedy@aecom.com">Robert.kennedy@aecom.com</a>	AECOM planning team
Tim Iannuzzi	ARCADIS for Tierra Solutions, Inc.	410.295.1205	<a href="mailto:tim.ianuzzi@arcadis-us.com">tim.ianuzzi@arcadis-us.com</a>	Technical Committee (TC) member
Diane Waldschmidt	EDS for Tierra Solutions, Inc.	412.486.6989	<a href="mailto:dwaldschmidt@eds-us.net">dwaldschmidt@eds-us.net</a>	TC member
Cliff Firstenberg	Tierra Solutions, Inc.	757.258.7720	<a href="mailto:cefirstenberg@cox.net">cefirstenberg@cox.net</a>	TC member
Paul Brzozowski	Tierra Solutions, Inc.	732.426.5851	<a href="mailto:Paul.brzozowski@tierra-inc.com">Paul.brzozowski@tierra-inc.com</a>	TC member
Suzanne Replinger	Windward Environmental	206.378.1364	<a href="mailto:suzanner@windwardenv.com">suzanner@windwardenv.com</a>	Ecological Risk Assessment (ERA) team
Karen Tobiason	Windward Environmental	206.378.1364	<a href="mailto:karent@winwardenv.com">karent@winwardenv.com</a>	ERA team
Rafael Canizares	Moffatt & Nichol	212.768.7454	<a href="mailto:rcanizares@moffattnichol.com">rcanizares@moffattnichol.com</a>	CFT modeling team
Rooni Mathew	Moffatt & Nichol	212.768.7454	<a href="mailto:rmathew@moffattnichol.com">rmathew@moffattnichol.com</a>	CFT modeling team
Leo Postma	Deltares	31.(0)15.285.8	<a href="mailto:Leo.postma@deltares.nl">Leo.postma@deltares.nl</a>	CFT modeling team
Richard Wroblewski	Givaudan Fragrances Corp.	973.448.6339	<a href="mailto:Richard.Wroblewski@givaudan.com">Richard.Wroblewski@givaudan.com</a>	TC member

**Comments/Decisions:**

The above parties discussed the development of the CWCM program, with the DUOs and DQOs defined by the end users (risk assessors and modeling teams). It was determined that the best approach to the CWCM program was to provide a phased approach, including both SV and HV sampling. This is consistent with FSP1 (MPI 2006a).

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<b>Project Name:</b> RI Water Column Monitoring/SV Chemical Data Collection <b>Projected Date(s) of Sampling:</b> October 2010 <b>Project Manager:</b> Bill Potter/ Robert Law			<b>Site Name:</b> Diamond Alkali OU 2 - LPRRP RI/FS <b>Site Location:</b> LPRSA	
<b>Date of Session:</b> August 11, 2010 <b>Scoping Session Purpose:</b> Discussion among de maximis, inc./ AECOM/ Moffatt & Nichol/USEPA for 2010 SV CWCM program.				
Name	Affiliation	Phone #	E-mail Address	Project Role
Bill Potter	de maximis, inc.	908.735.9315	<a href="mailto:otto@demaximis.com">otto@demaximis.com</a>	CPG Project Coordinator
Robert Law	de maximis, inc.	908.735.9315	<a href="mailto:rlaw@demaximis.com">rlaw@demaximis.com</a>	CPG Project Coordinator
Kristen Durocher	AECOM	603.528.8916	<a href="mailto:kristen.durocher@aecom.com">kristen.durocher@aecom.com</a>	CWCM Task Manager
Alice Yeh	USEPA	212.637.4427	<a href="mailto:Yeh.alice@epa.gov">Yeh.alice@epa.gov</a>	USEPA RPM
AmyMarie Accardi-Dey	The Louis Berger Group, Inc. (LBG)	914.798.3712	<a href="mailto:aaccardidey@loiusberger.com">aaccardidey@loiusberger.com</a>	NBSA oversight for USEPA
William Sy	USEPA	732.632.4766	<a href="mailto:Sy.william@epa.gov">Sy.william@epa.gov</a>	Project
Ed Garland	HDR/HydroQual, Inc. (HQI)	201.529.5151	<a href="mailto:Egardland@hydroqual.com">Egardland@hydroqual.com</a>	USEPA consultant
Ed Garvey	LBG	914.798.3712	<a href="mailto:egarvey@louisberger.com">egarvey@louisberger.com</a>	NBSA oversight for USEPA
Elizabeth Barrows	Battelle	631.941.3213	<a href="mailto:barrowse@battelle.org">barrowse@battelle.org</a>	USEPA consultant
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Jim Fitzpatrick	HQI	201.529.5151	<a href="mailto:jfitzpatrick@hydroqual.com">jfitzpatrick@hydroqual.com</a>	USEPA consultant
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Marian Olsen	USEPA	212.637.4313	<a href="mailto:Olsen.marian@epa.gov">Olsen.marian@epa.gov</a>	USEPA HHRA
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Ricardo Petroni	Anchor-QEA	201.930.9890	<a href="mailto:rpetroni@anchorgea.com">rpetroni@anchorgea.com</a>	TC consultant
Sharon Budney	CDM	732.590.4662	<a href="mailto:budneysl@cdm.com">budneysl@cdm.com</a>	USEPA consultant
Stephanie Vaughn	USEPA	212.637.3914	<a href="mailto:Vaughn.stephanie@epa.gov">Vaughn.stephanie@epa.gov</a>	LPRSA RPM
Tom Gallagher	HQI	201.529.5151	<a href="mailto:tgallagher@hydroqual.com">tgallagher@hydroqual.com</a>	USEPA consultant
Rafael Canizares	Moffatt & Nichol	212.768.7454	<a href="mailto:rcanizares@moffattnichol.com">rcanizares@moffattnichol.com</a>	CFT modeling team
Rooni Mathew	Moffatt & Nichol	212.768.7454	<a href="mailto:rmathew@moffattnichol.com">rmathew@moffattnichol.com</a>	CFT modeling team

### Comments/Decisions:

Representatives of the CPG LPR Project Team met with USEPA and its contractors to discuss the overall scope of the CWCM program, and the general terms of the SV QAPP.

The overall design of the SV CWCM program was presented to USEPA and its contractors. The program outline was framed within the context of the larger CWCM program, which will include HV sampling which will be provided in a separate QAPP.

The program is complex and several questions were asked for clarification purposes by USEPA and its

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contractors. The following questions related to the HV sampling:

- 1) Will the SV QAPP include information about the HV program, including number of samples, number of stations, number of events, and analyte list?

Response: The HV program is still being developed. The CPG and its contractors would like to meet with USEPA and their contractors to discuss the HV program. The SV QAPP will allude to the HV program, and the overall draft DUOs for the HV program.

- 2) A comment was made that analysis of the contaminant concentration in the solids fraction of the boundary conditions (i.e., tributaries), rather than the whole water sample, would be the most useful data for estimation of inputs from the LPRSA tributary boundaries. (Ed Garvey, LBG)
- 3) Based on a question by AmyMarie Accardi-Dey (LBG), clarification was provided that the SV program would utilize "standard" water volumes, such as 1 to 2 L for semivolatile organic compounds (SVOCs), and that the HV program would utilize large volumes (as needed) to lower the detection limits to meet RA data quality levels.
- 4) Based on a question from Ed Garvey (LBG), clarification was provided that the SV program would provide whole water data, with the exception of some metals for which aquatic life water quality criteria were based on the dissolved fraction, and hexavalent chromium, which would be dissolved phase only. The HV program would provide dissolved water column organic concentrations, and the associated concentrations on the solid fraction. The HV program would provide any site-specific partition coefficients to the model. The model does not integrate variability of partition coefficients.
- 5) A general description of the HV program was provided indicating that the CPG is considering using an Infiltrax-type system and two sampling events. The numbers of locations, analyte list and specific methods have yet to be determined.

As a result of this meeting, it was agreed that a scoping meeting with USEPA and their contractors should be convened to discuss the HV program. This meeting was not scheduled.

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<b>Project Name:</b> RI Water Column Monitoring/SV Chemical Data Collection			<b>Site Name:</b> Diamond Alkali OU 2 - LPRRP RI/FS	
<b>Projected Date(s) of Sampling:</b> October 2010			<b>Site Location:</b> LPRSA	
<b>Project Manager:</b> Bill Potter/ Robert Law				
<b>Date of Session:</b> August 20, 2010				
<b>Scoping Session Purpose:</b> Discussion between AECOM and HQI for 2010 SV CWCM program.				
<b>Name</b>	<b>Affiliation</b>	<b>Phone #</b>	<b>E-mail Address</b>	<b>Project Role</b>
Kristen Durocher	AECOM	603.528.8916	<a href="mailto:kristen.durocher@aecom.com">kristen.durocher@aecom.com</a>	CWCM Task Manager
Ed Garland	HQI	201.529.5151	<a href="mailto:Egardland@hydrolqual.com">Egardland@hydrolqual.com</a>	USEPA consultant

**Comments/Decisions:**

- 1) HQI expressed concerns with the detection limits that could be achieved using the analytical methods of the SV CWCM program.

Response: AECOM said that the CPG would take this under advisement, and would consider using the HV CWCM program to achieve lower detection limits for a sub-set of constituents. The CPG would analyze a sub-set of SV CWCM data using rapid turnaround time and these data would be reviewed by the CPG and USEPA to determine if the SV CWCM objectives were being met.

- 2) HQI mentioned that the CPG had not addressed a DUO to develop estimates of loads above Dundee Dam and the three major freshwater tributaries to the LPR. HQI interpreted that the Contaminant Assessment and Reduction Program (CARP) data indicate dissolved phase constituents had less variability than the particulate phase.

Response: AECOM said that the CPG was sampling the three tributaries and above Dundee Dam during the SV CWCM program during every event. The CPG would take this request for additional data under advisement.

The parties agreed that a series of meetings to discuss issues related to the HV CWCM program would be useful.

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<b>Project Name:</b> RI Water Column Monitoring/High Volume Chemical Data Collection  <b>Projected Date(s) of Sampling:</b> <b>Project Manager:</b> Bill Potter/ Robert Law			<b>Site Name:</b> Diamond Alkali OU 2 - LPRRP RI/FS <b>Site Location:</b> LPRSA	
<b>Date of Session:</b> January 26, 2012 <b>Scoping Session Purpose:</b> Discussion among de maximis, inc./AECOM/Windward/Moffatt & Nichol/USEPA for 2012 HV program.				
Name	Affiliation	Phone #	E-mail Address	Project Role
Bill Potter	de maximis, inc.	908.735.9315	<a href="mailto:otto@demaximis.com">otto@demaximis.com</a>	CPG Project Coordinator
Robert Law	de maximis, inc.	908.735.9315	<a href="mailto:rlaw@demaximis.com">rlaw@demaximis.com</a>	CPG Project Coordinator
Cliff Firstenberg	Tierra Solutions, Inc.	757.258.7720	<a href="mailto:cefirstenberg@cox.net">cefirstenberg@cox.net</a>	TC member
Pravi Shrestha <a href="mailto:pshretha@exponent.com">pshretha@exponent.com</a>	Exponent	949.242.6037	<a href="mailto:pshretha@exponent.com">pshretha@exponent.com</a>	Tierra Solutions, Inc. consultant
Ricardo Petroni	Anchor QEA	201.930.9890	<a href="mailto:rpironi@anchorqea.com">rpironi@anchorqea.com</a>	TC consultant
Peter Israelsson	Anchor QEA	201.930.9890	<a href="mailto:pisraelsson@anchorqea.com">pisraelsson@anchorqea.com</a>	TC consultant
Rafael Canizares	Moffatt & Nichol	212.768.7454	<a href="mailto:rcanizares@moffattnichol.com">rcanizares@moffattnichol.com</a>	CPG modeling team
Rooni Mathew	Moffatt & Nichol	212.768.7454	<a href="mailto:rmathew@moffattnichol.com">rmathew@moffattnichol.com</a>	CPG modeling team
Ed Garland	HQI	201-529-5151	<a href="mailto:Edward.Garland@hdrinc.com">Edward.Garland@hdrinc.com</a>	USEPA consultant
Eugenia Naranjo	USEPA	212.637.3558	<a href="mailto:Naranjo.Eugenia@epamail.epa.gov">Naranjo.Eugenia@epamail.epa.gov</a>	NBSA RPM
Stephanie Vaughn	USEPA	212.637.3914	<a href="mailto:Vaughn.stephanie@epa.gov">Vaughn.stephanie@epa.gov</a>	LPRSA RPM
James Wands	HQI	201-529-5151	<a href="mailto:James.Wands@hdrinc.com">James.Wands@hdrinc.com</a>	USEPA consultant
Tarun Singh	HQI	201-529-5151	<a href="mailto:Tarun.Singh@hdrinc.com">Tarun.Singh@hdrinc.com</a>	USEPA consultant

### Comments/Decisions:

USEPA and its consultants presented the DUOs for the high-volume and 2L SV CWCM data. Four main DUOs were expressed by USEPA:

1. Site-specific partition coefficients
2. Lower detection limits
3. Comparison of model computations to dissolved and particulate phases
4. Estimation of boundary conditions

Some examples of partitioning data from CARP were presented by HQI to the CPG; there was no in-depth analysis of the data provided. There were indications of variability but HQI did not provide any explanation of whether the variability was driven by salinity or noise from sampling and analysis errors. The CPG suggested that further analysis of the CARP partitioning data might be warranted to determine if collection of additional data would actually improve the partition coefficients being used in the fate and transport model. Tierra expressed concerns with the CARP HV data. As a result of this meeting, USEPA directed the CPG to develop a proposal for the HV sampling program consistent with USEPA's DUOs.

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<b>Project Name:</b> RI Water Column Monitoring/High Volume Chemical Data Collection <b>Projected Date(s) of Sampling:</b> <b>Project Manager:</b> Bill Potter/ Robert Law			<b>Site Name:</b> Diamond Alkali OU 2 - LPRRP RI/FS <b>Site Location:</b> LPRSA	
<b>Date of Session:</b> March 22, 2012 <b>Scoping Session Purpose:</b> Discussion among de maximis, inc./AECOM/Windward/Moffatt & Nichol/USEPA for 2012 HV program.				
Name	Affiliation	Phone #	E-mail Address	Project Role
Bill Potter	de maximis, inc.	908.735.9315	<a href="mailto:otto@demaximis.com">otto@demaximis.com</a>	CPG Project Coordinator
Robert Law	de maximis, inc.	908.735.9315	<a href="mailto:rlaw@demaximis.com">rlaw@demaximis.com</a>	CPG Project Coordinator
Kristen Durocher	AECOM	603.528.8916	<a href="mailto:kristen.durocher@aecom.com">kristen.durocher@aecom.com</a>	CWCM Task Manager
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### Comments/Decisions:

The CPG submitted a memorandum to USEPA that outlined the proposed HV sampling program. USEPA reviewed the memorandum and it was discussed at the meeting. USEPA's main concern was meeting the DUOs it presented to the CPG during the January 26, 2012 meeting. USEPA stated during this meeting/call that there are four primary DUOs:

- Development of partition coefficients
- Lower detection limits
- Generation of dissolved and particulate phase concentrations to be used to compare modeling computations.
- Estimation of boundary conditions

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The USEPA modeling team provided comments and asked a number of questions about the proposed program:

- 1) The proposed program will not provide information on loadings at freshwater and open boundaries.

Response: The SV CWCM program was designed to capture data at the boundaries (including the tributaries). To date, data from only one SV event are available; additional SV events have been conducted or are planned and could provide data for this DUO.

- 2) USEPA stated that the data from the first SV event shows non-detects at a majority of the stations in NB. The CPG noted that the non-detects are located in the southern portion of the Bay; it was agreed that this was the correct observation. One of the DUOs of the HV program is to develop a better dataset of chemical of potential concern (COPC) concentrations in NB. USEPA believes the proposed HV program with only 2 stations in the Bay that are sampled only once will not provide adequate data for this DUO.

Response: To date, data from only one SV event are available; additional SV events have been conducted or are planned and could provide data for this DUO.

- 3) HQI stated that the CARP data show more variability in whole-water COPC concentrations than in particulate-phase COPC concentrations at the boundaries. Therefore, having particulate phase measurements at the boundaries will provide a better estimate of the loads coming into the LPRSA and NBSA.

Response: CPG members expressed concerns with the quality of the CARP data. Tierra asked HQI to define which boundary conditions specifically require these data. Due to logistical concerns that could be associated with implementing a HV sampling program, sampling every boundary condition is not justified. HQI indicated that, during a flood tide, NB South could be considered a boundary condition. The group agreed, however, that sampling high volumes would likely require time that would prohibit sampling at just flood tide.

- 4) USEPA stated that a majority of the logistical concerns could be avoided by using "known methods" for sampling, and that the USEPA would likely approve an Infiltrix-type system.

Response: Tierra expressed concerns with Infiltrix based on published and anecdotal evidence of performance problems.

- 5) The USEPA envisions the proposed HV program as a pilot program or the first event in a multi-event program.

Response: The data from the SV rounds that have been completed and the first round of the proposed HV program should be reviewed first before determining the need for additional data.

- 6) The USEPA modeling team noted that the CPG team has extensive data from the Hudson River

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(Anchor QEA) and Housatonic (Moffatt and Nichol) that could be reviewed to estimate the variability in boundary loading estimates.

The CPG and USEPA modeling teams agreed to modify the program provided in the CPG memorandum to include a station above Dundee Dam for estimation of freshwater inputs to the LPR and to move the location proposed at RM 1.4 to RM 4.2, where PCDD/Fs were detected during SV Event #1. USEPA said they would provide formal feedback on the memorandum.

**The problem to be addressed by the project:**

Sampling of chemical concentrations in surface waters is a required element of LPRRP FSP1 for completion of the LPRSA RI/FS per the May 2007 Settlement Agreement and SOW (USEPA 2007a). As stated in Worksheet #11 of the SV CWCM QAPP (AECOM, 2011a), large volume sampling data "will be collected to augment the development of partition[ing] parameters" that were developed as part of NY/NJ HEP (2004) CARP. USEPA's modeling contractor developed partition coefficients using the CARP data. To meet the USEPA's directive to conduct a HV program, the large volume data collection should include the following elements:

- 1) Measurement of PCDD/Fs and PCBs in particulate and dissolved phases of the water column; and,
- 2) Collection of samples at different salinities to determine if sorption partitioning varies with salinity.

The primary objective of the HV CWCM program is provide estimates of in-situ sorption partition coefficients to be used to set partitioning in the LPR/NB CFT model. The CPG Modeling Team will develop a Technical Memorandum for USEPA review that describes the partition coefficient development. The methods for development will be finalized upon review of the HV data. Other objectives include estimating boundary conditions, lowering detection limits, and comparing model concentrations to dissolved and particulate phases. To achieve these goals, it is necessary to target a volume large enough (i.e., as much as 1000 L) to accurately measure the concentrations in the dissolved and particulate phases. This volume is likely to be controlled by the mass of solids needed to measure the particulate phase. The dissolved phase of the HV CWCM program for all constituents is operationally defined as the phase passing through the solids separator unit and a 0.7 micron flat filter. Data from the first two or three SV CWCM sampling events will be used to estimate the needed volume (see Worksheet #15).

The field and laboratory data collected during this program will be used in the RI/FS to:

- Develop improved sorption partition coefficients for PCDD/Fs and PCBs from areas of lower and higher salinity in the LPRSA and NBSA.
- Characterize the inputs of PCDD/Fs and PCBs at the boundaries of the LPRSA and NBSA by HV sampling in Kill van Kull and above Dundee Dam. This will aid in the characterization of potential sources of PCDD/Fs and PCBs external to the LPRSA and NBSA.
- Collect data to characterize the dissolved and particulate phase concentrations of contaminants in surface water from the LPRSA and NBSA. Collection of these data will assist in understanding the relationship between the particulate-bound and dissolved (operationally defined as passing through a 0.7 micron flat filter) concentrations of PCDD/Fs and PCBs in the water column under various salinity regimes.

The introduction to the QAPP provides background site information. The PQOs provided in Worksheet #11 include more detail for each sampling objective.

<b>Who will use the data?</b>
CPG, Tierra Solutions, Inc. and USEPA and its Partner Agencies will use these data for CERCLA-related assessments, including the LPRSA RAs and food web model (FWM), the LPR/NB CFT Model and other tasks associated with both the LPRSA RI/FS and the NBSA RI/FS.
<b>What will the data be used for?</b>
<p>The following presents the DUOs for the CWCM HV chemical data collection program:</p> <ul style="list-style-type: none"> <li>• The data will be used as part of the RI/FS to characterize the dissolved and particulate phase concentrations of PCDD/Fs and PCBs in surface water;</li> <li>• The data will be used as part of the RI/FS to estimate sorption partition coefficients of PCDD/Fs and PCBs in the LPR and NB;</li> <li>• The data will be used to estimate PCDD/F and PCB concentrations at the boundaries of the LPR and NB;</li> <li>• Consistent with the <i>LPRSA Human Health and Ecological Risk Assessment Streamlined 2009 Problem Formulation Document</i> (PFD) (Windward and AECOM 2009), the dissolved phase data will be used to assess potential exposure dose and risk from direct dermal contact with COPCs in surface water by human receptors;</li> <li>• The data will be used to estimate contribution of dissolved COPCs in surface water to the bioaccumulation of COPCs in the food chain.</li> <li>• The dissolved and particulate phase data will be used by human health and ecological risk assessment to assess potential exposure to receptors.</li> </ul>
<b>What types of data are needed (matrix, target analytes, analytical groups, field screening, on-site analytical or off-site laboratory techniques, sampling techniques)?</b>
<p>Worksheet #15 provides the list of target constituents for the HV CWCM program. The analyte list was developed in consultation with USEPA (Worksheet #9) and includes the Group A HOCs (i.e., PCDD/Fs and PCBs) from the SV QAPP (AECOM, 2011a). Samples submitted for analysis will include solids separated from the water in the field, and the corresponding sorption medium through which the filtrate has been passed in the field. The sorption medium to be used in the HV sampling program is polyurethane foam (PUF), contained in a stainless steel cartridge. For the first round of HV sampling, two PUF cartridges will be used. The second PUF cartridge will serve to monitor the potential for "break-through" of HOCs and use of the second PUF cartridge will be evaluated following completion of the first round of HV sampling and analysis. The separated solids and PUF data will be reported from the laboratory as mass per sample. The goal of the sorption media (PUF) is the quantitative collection of dissolved constituents into a media that can then be extracted to yield a mass present in the volume of water. Additional physical parameters such as DOC, POC, and SSC will also be collected to support the development of the partition coefficients. These data will be reported as mass per volume and will be used to calculate mass per volume for the HV HOCs, as described in Worksheet #37.</p> <p>Field measurements will include continuous surface to near-bottom recording of dissolved oxygen, pH, specific conductivity, temperature, and salinity. Flow rates will be monitored and recorded at a specific interval per SOP SW-19 (Appendix A). Suspended sediment particle size and concentrations will be recorded continuously using a laser <i>in situ</i> scatter and transmission (LISST) deployed at sample depth. Sample volumes will be recorded by the PR2900. Other data to be recorded in the field include time of day, associated tide cycle during the sampling, total water column depth, location of sample relative to thalweg and navigational channel, current and 48 hour previous meteorological conditions, wind speed and direction, and other relevant conditions such as presence of algae blooms. Physical and chemical tests will be performed on the water samples at the laboratories identified in Worksheet #30 according to methods listed in Worksheet #23.</p> <ul style="list-style-type: none"> <li>• Dissolved concentrations of PCBs (congeners and homologs) and PCDD/Fs will also be used for evaluation of the dermal exposure pathway in the HHRA, in addition to the DUOs provided above.</li> <li>• Physical parameters (i.e., SSC) will be used to evaluate the volumetric concentrations of PCBs and PCDD/Fs in the water (see Worksheet #15)</li> </ul>

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<p>and the associated DOC and POC will be used to calculate partition coefficients for the CFT model.</p> <ul style="list-style-type: none"> <li>Field parameters including pH, salinity, specific conductivity, temperature, and dissolved oxygen, will be collected to aid in characterizing non-chemical conditions, as well as for use in developing inputs to the CFT model and development of partition coefficients.</li> <li>The LISST will be used to monitor the particle size and concentration in the water column to aid in monitoring the changing of the flat filter (i.e., if the data indicate a high concentration of large particle size solids is passing through the system, the pressure may build quickly, mandating the need for a filter change per SOP SW-19).</li> <li>The total volume of water collected from each location will be recorded, as well as pump rate and sampling duration (start time and stop time). The tide stage will be recorded. The HV sampling will target the incoming tide, to the extent practical, minimizing ebb tide sampling.</li> <li>Flow rate will be monitored and recorded every 15 minutes.</li> </ul>
<p><b>How “good” do the data need to be in order to support the environmental decision?</b></p> <ul style="list-style-type: none"> <li>Upon completion of the HV sampling event, the overall quality of the data will be examined. If groups of chemicals are undetected or rejected, the HV program will be re-assessed and may be modified. Worksheet #15 provides information on the detection and quantitation limits (QLs) for the HV data. Worksheet #12 provides the acceptance criteria and limits for QC.</li> <li>The data need to be collected and analyzed in conformance with various USEPA Region 2 QA guidance and manuals (<a href="http://www.epa.gov/region2/qa/documents.htm">http://www.epa.gov/region2/qa/documents.htm</a>).</li> </ul>
<p><b>How much data are needed (number of samples for each analytical group, matrix, and concentration)?</b></p> <ul style="list-style-type: none"> <li>Sample collection is planned at two locations in the LPRSA (RM 4.2 and RM 10.2), and two locations in NBSA (NB South and NB Northeast). These locations were chosen to be representative of a range of salinity regimes in the LPRSA and NBSA such that the partition coefficients to be derived using these data are representative of low and high salinity gradients in each study area.</li> <li>In addition, one location in each area will be sampled as representative of boundary conditions: above Dundee Dam for LPR and at Kill Van Kull for NBSA.</li> <li>One round of sampling will initially be conducted to fulfill the objectives of the HV sampling program. The data will be submitted for rapid turnaround analysis (i.e., 30-day). The CPG will review the HV data and discuss them with USEPA, and additional sampling rounds will be conducted, if warranted. The use of a secondary PUF cartridge will be reviewed following the first HV sampling event.</li> <li>From each location, four samples will be collected: one sample of solids separated from the water column to be analyzed for PCBs (congeners and homologs) and PCDD/Fs; one sample of a primary PUF cartridge through which the filtrate has been passed (representative of the dissolved fraction) to be analyzed for PCBs and PCDD/Fs; one sample of a secondary PUF cartridge through which the filtrate has been passed to check on HOC breakthrough and ensure more complete HOC quantification; and four time-weighted composite samples of whole water for analyses of</li> </ul>

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POC, DOC and SSC. The primary and secondary sorption media samples will be analyzed and reported separately, and a calculated sum will be included in the EDD. The HOC mass present in the filtered water will be considered to be the sum of the two results. The POC, DOC and SSC samples will be collected from a 20L carboy, calibrated to fill simultaneously with the collection of PCDD/F and PCB samples. These four samples will be analyzed separately by the laboratory and the results averaged for estimation of SSC, DOC and POC for each HV sample. Refer to "Sampling Methodology" in Worksheet #11 for more details.

#### **Where, when, and how should the data be collected/generated?**

Since partition coefficients can be dependent on salinity, the data are intended to address the range of salinity in the water column throughout the LPRSA and NBSA. Locations have been selected from the LPR and NB that provide an example of the higher and lower end of salinity in each area. The samples collected should be spatially discrete, with locations from two locations in the LPR and two locations in NB.

- From the LPRSA, locations have been selected that are consistent with locations sampled during the SV CWCM sampling events. Freshwater will be represented by a location upstream of the predicted salt wedge, at RM 10.2. Saline water will be represented by sampling from a location in the salt wedge, at or near RM 4.2. If flows are < 1,000 cfs at Dundee Dam; the specific location will be determined in consultation with the CPG modeling team, consistent with Exhibit 1 of Appendix A to the SV CWCM QAPP (AECOM, 2011a).
- From the NBSA, locations have been selected that are consistent with locations sampled during the SV CWCM sampling events. Low salinity will be represented by the sampling location identified as NB Northeast, which is located in a sub-tidal area on the eastern shore north of Branch Channel. During SV CWCM sampling, salinity at NB Northeast was the lowest among the NB locations. High salinity will be represented by the sampling location identified as NB South, which is located on the eastern side of the shipping channel off the southern edge of the Elizabeth Port Authority Marine Terminal. During SV CWCM sampling, salinity at NB South was the highest among the NB locations.

In addition to the development of sorption partition coefficients in the LPR and NB, additional data will be collected from the boundaries at the LPRSA and NBSA. These data will be used in the model to refine the concentrations of PCDD/Fs and PCBs that are present at potentially very low levels.

- In the LPRSA, the boundary condition will be represented by the SV CWCM sampling location above Dundee Dam, where upstream contamination may occur.
- In NBSA, the boundary condition will be represented by the SV CWCM location in Kill van Kull, which is the waterway joining NB to the greater NY/NJ harbor system.

#### **Proposed Sampling Depth**

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Samples will be collected from each location at one depth to provide a sample representative of the location. Samples from the NBSA and LPR will be collected from three feet above the bottom, consistent with the deep interval from the SV CWCM QAPP (AECOM, 2011a). Solids concentrations are slightly higher in the deep interval, and salinity is likely to be less variable. Above Dundee Dam, the sample depth will be mid water column, also consistent with the SV CWCM QAPP (AECOM, 2011a).

#### **Temporal Considerations**

- Sampling may occur any time during the year, but at flows consistent with the SV CWCM Routine Events (400 – 3,000 cfs at Dundee Dam). This will provide data that represents the "normal" flow condition in the river.
- Sampling will be conducted independent of tides. Time on station and duration of sampling will be determined based on volume of water required (see Worksheet #15) and pump flow rates. To the extent possible, the window of time for incoming tides will be targeted for tidal boundary locations.
- Sampling should occur during the summer 2012, if possible, to generate data in a timely manner.

#### **Sampling Methodology**

HV sampling is planned to be conducted using a PR2900 sampling system designed by Gravity Environmental. Details of the HV field sampling methods are provided in the field SOPs (Appendix A) and Worksheet #21. The PR2900 uses a peristaltic pump with Teflon-lined dedicated tubing to draw water through a vortex solids separation system with a flat laboratory grade 0.7 micron filter to capture remaining solids. To capture neutrally-buoyant algae-like particles that have been observed in the LPR, a pre-filter consisting of laboratory-cleaned glass wool packed into a stainless steel in-line cartridge will be employed during the HV sampling. Refer to SOP SW-19 (Appendix A) for more details. The solids captured in the separation system and the solids on the flat filter(s) and the glass wool are combined to represent a single total particulate solids sample for subsequent extraction and analysis. The water is then passed through two polyurethane foam (PUF) sorption media cartridges arranged in series to capture organic analytes in the filtrate. Dissolved phase hydrophobic organic compounds diffuse into the PUF polymer and are retained for subsequent solvent extraction and analysis. Two PUF cartridges will be used in series to ensure more complete extraction of HOC from the water as well as on a check on the ability of the single PUF cartridge to extract the majority of the HOC. If a subsequent HV effort is pursued, the results of this effort will be used to assess whether a single PUF cartridge is sufficient.

Flow rates are low (approximately 1.5 L/minute [min]) to avoid clogging of the filters (refer to Appendix A, Field SOPs). To meet the ultra-low detection limits required for the PCDD/Fs and PCBs (see Worksheet #15), it is necessary to sample large volumes of water over several hours. The whole water sample for POC, DOC and SSC will be collected by pumping approximately 15 L of water into a carboy at a rate that will ensure the carboy is filled in the same amount of time (pumped during the same time period) as the HV sample for the PCDD/Fs and PCBs, without overfilling. The calculation of flow rates is provided in Worksheet #21. The water in the carboy will be continuously homogenized as it is filled using a 3 inch stir bar and stir plate. Upon completion of the HV sampling, the water in the 20 L carboy will be subsampled for the physical parameters.



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Four sub-samples will be collected from the carboy. The results will be averaged (see Worksheet #37) to estimate concentrations in the carboy. Details are provided in the Field SOPs (Appendix A).

#### **Who will collect and generate the data?**

As described in Worksheet #7, AECOM, working on behalf of the CPG, will provide the field sampling coordination and most of the field personnel required to conduct the HV CWCM sampling and will provide laboratory and data validation coordination and support. Additional field personnel will be provided by Gravity Environmental and OSI.

#### **How will the data be reported?**

Daily updates of locations and sample collection progress will be communicated as described in Worksheet #6, including communication with the USEPA RPM.

Regular reporting on the progress of the CWCM program will be performed as part of the overall monthly progress reporting for the LPRSA RI/FS and will include the following:

- Brief summary of any field surveys performed during the previous month (type of survey, dates, number of samples collected, issues of note, and deviations from the program QAPP).
- Delivery of validated data, processed data, and raw data (as applicable). Requirements for validated data submittals are prescribed by the Region 2 guidance on standardized EDDs at <http://www.epa.gov/region02/superfund/medd.htm>. The EDD will be organized such that surrogate recoveries are easily connected to the field samples.

Following completion of the HV CWCM program, a data summary memorandum will be prepared that will include the following:

- Summary of the overall monitoring effort including a full description of any deviations from the QAPP.
- Sample summary tables providing raw (mass per sample) and dissolved and particulate contaminant concentrations (mass per volume) for HV HOCs, calculated per Worksheet #37.
- Individual subsample and average concentrations of SSC, POC and DOC for each location.
- Physical parameter data collected during sampling, including sampling conditions and sample coordinates as well as time of sample collection, tide stage, etc...
- A map of final sample locations
- Presentation of a data quality review and summary of data usability.



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Discussion on achievement of the PQOs and the need for any recommended follow-up investigations.

#### **How will the data be archived?**

The data will be managed daily and archived per the AECOM DMP (AECOM 2010b) (see Worksheet #29). Electronic data will be archived by ddms.

Matrix	Solids (Separated Solids)				
Analytical Group <sup>a</sup>	PCBs – Congeners and Homologs				
Concentration Level	Low				
Sampling Procedure <sup>b</sup>	Analytical Method/SOP <sup>c</sup>	Data Quality Indicator (DQIs)	Measurement Performance Criteria <sup>d</sup>	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
SW-19	AP-3	Accuracy/Bias	a) No Target Compound >25% of adjusted QL b) If detected, the concentration should be less than the QL or <10 times the highest concentration found in the sample batch; c) Signal to noise (S/N) should be >10:1 for isotopically labeled standard added before extraction; d) Estimated Detection Limit (EDL) ≤ 50% of the adjusted QL; e) Recoveries of the isotopically labeled standard should be 40% minimum or meet the requirements of c and d above.	Method Blank (MB)/Instrument Blank	A
	AP-3	Accuracy/Bias-Contamination	No target compounds >1/10 concentration in associated samples	Equipment Rinsate Blanks	S&A

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**QAPP Worksheet #12 (UFP-QAPP Manual Section 2.6.2) Measurement Performance Criteria Table**

Sampling Procedure <sup>b</sup>	Analytical Method/SOP <sup>c</sup>	DQIs	Measurement Performance Criteria <sup>d</sup>	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
SW-19 (con't)	AP-3	Accuracy/Bias	Native compounds by isotope dilution percent differences (%D) vs. initial calibration (ICAL) $\leq 30\%$ ; Native compounds measured against an isotopic isomer vs. ICAL %D = 50%; Labeled standard %D vs. ICAL $\leq 50\%$ ; Native Compound relative percent differences (RPDs) $\leq 20\%$ for isotope dilution and $\leq 30\%$ for isotopic isomer; Standard RPDs $\leq 50\%$	Batch Control Spike	A
	AP-3	Accuracy/Bias	Per EPA Method 1668B Table 6	Pre-extraction Internal Standards	A
	AP-3	Accuracy/Bias	Supplier Certified Limits	Performance Evaluation (PE) Sample	A
	AP-3	Precision <sup>e</sup>	RPD $\leq 50\%$ if both samples are $> 5x$ Estimated Minimum Level (EML) or absolute difference between concentrations $< 2x$ EML if sample and/or field duplicate are $\leq 5x$ EML	Field Duplicate	S&A

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Sampling Procedure <sup>b</sup>	Analytical Method/SOP <sup>c</sup>	Data Quality Indicator (DQIs)	Measurement Performance Criteria <sup>d</sup>	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
SW-19 (con't)	AP-3	Completeness	≥ 90%	Data Completeness Check	S&A

- <sup>a</sup> Refer to QAPP Worksheet #15 for a complete list of analytes for each analytical group  
<sup>b</sup> Refer to QAPP Worksheet #21  
<sup>c</sup> Refer to QAPP Worksheet #23  
<sup>d</sup> Analyte specific limits may be found in the Laboratory SOP located in Appendix B  
<sup>e</sup> Field duplicates (as co-located samples) will be the only precision data quality indicators (DQI) for the HV solids samples. Laboratory duplicates are not possible, as the entire sample is required for the extraction, and cannot be split.

<b>Matrix</b>	Solids (Sorption Media [PUF]) <sup>a</sup>				
<b>Analytical Group<sup>b</sup></b>	PCBs – Congeners and Homologs				
<b>Concentration Level</b>	Low				
Sampling Procedure <sup>c</sup>	Analytical Method/SOP <sup>d</sup>	DQIs	Measurement Performance Criteria <sup>e</sup>	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
SW-19	AP-3	Accuracy/Bias	a) No Target Compound >25% of adjusted QL b) If detected, the concentration should be less than the QL or <10 times the highest concentration found in the sample batch; c) S/N should be >10:1 for isotopically labeled standard added before extraction; d) EDL ≤ 50% of the	MB/Instrument Blank	A



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			adjusted QL e) Recoveries of the isotopically labeled standard should be 40% minimum or meet the requirements of c and d above		
	AP-3	Accuracy/Bias-Contamination	No target compounds >1/10 concentration in associated samples	Equipment Rinsate Blanks	S&A

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Sampling Procedure <sup>c</sup>	Analytical Method/SOP <sup>d</sup>	DQIs	Measurement Performance Criteria <sup>e</sup>	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
SW-19 (con't)	AP-3	Accuracy/Bias	Native compounds by isotope dilution %Ds) vs. ICAL $\leq$ 30%; Native compounds measured against an isotopic isomer vs. ICAL %D = 50%; Labeled standard %D vs. ICAL $\leq$ 50%; Native Compound RPDs $\leq$ 20% for isotope dilution and $\leq$ 30% for isotopic isomer; Standard RPDs $\leq$ 50%	Batch Control Spike	A
	AP-3	Accuracy/Bias	Per EPA Method 1668B Table 6	Pre-extraction Internal Standards	A
	AP-3	Accuracy/Bias	75-125%	Static Spike for monitoring analyte desorption during sampling	S&A
	AP-3	Accuracy/Bias	25-150%	Dynamic Spike for monitoring analyte capture efficiency during sampling	S&A
	AP-3	Accuracy/Bias	Recovery in secondary PUF < 20% of recovery in primary PUF	Secondary PUF for native compound, static spike, and dynamic spike breakthrough monitoring	S&A

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Sampling Procedure <sup>c</sup>	Analytical Method/SOP <sup>d</sup>	DQIs	Measurement Performance Criteria <sup>e</sup>	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
SW-19 (con't)	AP-3	Precision <sup>f</sup>	RPD $\leq$ 50% if both samples are $> 5x$ EML, or absolute difference between concentrations $< 2x$ EML if sample and/or field duplicate are $\leq 5x$ EML	Field Duplicate	S&A
	AP-3	Accuracy/Bias	70-130%	Alternate cleanup standards	A
	AP-3	Completeness	$\geq 90\%$	Data Completeness Check	S&A

<sup>a</sup> PUF is treated as a solid matrix from the perspective of the laboratory's analytical methods. The PUF data are used to estimate dissolved concentrations in the water column.

<sup>b</sup> Refer to QAPP Worksheet #15 for a complete list of analytes for each analytical group

<sup>c</sup> Refer to QAPP Worksheet #21

<sup>d</sup> Refer to QAPP Worksheet #23

<sup>e</sup> Analyte specific limits may be found in the Laboratory SOP and HV Sampling SOP addendum located in Appendix B

<sup>f</sup> Field duplicates (as co-located samples) will be the only precision DQI for the HV solids samples. Laboratory duplicates are not possible, as the entire sample is required for the extraction, and cannot be split.

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**QAPP Worksheet #12 (UFP-QAPP Manual Section 2.6.2) Measurement Performance Criteria Table**

Matrix	Solids (Separated Solids)				
Analytical Group <sup>a</sup>	PCDDs/Fs				
Concentration Level	Low				
Sampling Procedure <sup>b</sup>	Analytical Method/SOP <sup>c</sup>	DQIs	Measurement Performance Criteria <sup>d</sup>	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
SW-19	AP-1	Accuracy/Bias	a) No Target Compound >25% of adjusted QL b) If detected, the concentration should be less than the QL or <10 times the highest concentration found in the sample batch; c) S/N should be >10:1 for isotopically labeled standard added before extraction; d) EDL ≤ 50% of the adjusted QL e) Recoveries of the isotopically labeled standard should be 40% minimum or meet the requirements of c and d above	MB	A
	AP-1	Accuracy/Bias-Contamination	No target compound >QL	Equipment Rinsate Blanks	S&A

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**QAPP Worksheet #12 (UFP-QAPP Manual Section 2.6.2) Measurement Performance Criteria Table**

Sampling Procedure <sup>b</sup>	Analytical Method/SOP <sup>c</sup>	DQIs	Measurement Performance Criteria <sup>d</sup>	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
SW-19 (con't)	AP-1	Sensitivity	EDL < Project Action Limit (PAL)	Labeled Compounds	A
	AP-1	Accuracy/Bias	Native compound %D (vs. ICAL) ≤ 20%; Labeled Standard %D (vs. ICAL) ≤ 30%; Native Compound RPDs ≤ 10%; Labeled Standard RPDs ≤ 20%	Batch Control Spike	A
	AP-1	Accuracy/Bias	Supplier Certified Limits	PE Sample	A
	AP-1	Accuracy/Bias	Within statistical control limits	QC Standard	A
	AP-1	Precision <sup>e</sup>	RPD ≤ 50% if both samples are > 5x QL or absolute difference between concentrations < 2x QL if sample and/or field duplicate are ≤ 5x QL	Field Duplicate	S&A
	AP-1	Completeness	≥ 90%	Data Completeness Check	S&A

<sup>a</sup> Refer to QAPP Worksheet #15 for a complete list of analytes for each analytical group

<sup>b</sup> Refer to QAPP Worksheet #21

<sup>c</sup> Refer to QAPP Worksheet #23

<sup>d</sup> Analyte specific limits may be found in the Laboratory SOP located in Appendix B

<sup>e</sup> Field duplicates (as co-located samples) will be the only precision DQI for the HV solids samples. Laboratory duplicates are not possible, as the entire sample is required for the extraction, and cannot be split.

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**QAPP Worksheet #12 (UFP-QAPP Manual Section 2.6.2) Measurement Performance Criteria Table**

Matrix	Solids (Sorption Media [PUF]) <sup>a</sup>				
Analytical Group <sup>b</sup>	PCDDs/Fs				
Concentration Level	Low				
Sampling Procedure <sup>c</sup>	Analytical Method/SOP <sup>d</sup>	DQIs	Measurement Performance Criteria <sup>e</sup>	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
SW-19	AP-1	Accuracy/Bias	a) No Target Compound >25% of adjusted QL b) If detected, the concentration should be less than the QL or <10 times the highest concentration found in the sample batch; c) S/N should be >10:1 for isotopically labeled standard added before extraction; d) EDL ≤ 50% of the adjusted QL e) Recoveries of the isotopically labeled standard should be 40% minimum or meet the requirements of c and d above	MB	A
	AP-1	Accuracy/Bias-Contamination	No target compound >QL	Equipment Rinsate Blanks	S&A



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Sampling Procedure <sup>b</sup>	Analytical Method/SOP <sup>c</sup>	DQIs	Measurement Performance Criteria <sup>d</sup>	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
SW-19 (con't)	AP-1	Sensitivity	EDL<PAL	Labeled Compounds	A
	AP-1	Accuracy/Bias	Native compound %D (vs. ICAL) $\leq$ 20%; Labeled Standard %D (vs. ICAL) $\leq$ 30%; Native Compound RPDs $\leq$ 10%; Labeled Standard RPDs $\leq$ 20%	Batch Control Spike	A
	AP-1	Accuracy/Bias	75-125%	Static Spike for monitoring analyte desorption during sampling	S&A
	AP-1	Accuracy/Bias	40-130%	Dynamic Spike for monitoring analyte capture efficiency	S&A
	AP-1	Accuracy/Bias	Recovery in secondary PUF < 20% of recovery in primary PUF	Secondary PUF for native compound, static spike, and dynamic spike breakthrough monitoring	S&A
	AP-1	Accuracy/Bias	Within statistical control limits	QC Standard	A
	AP-1	Precision <sup>f</sup>	RPD $\leq$ 50% if both samples are > 5x QL, or absolute difference between concentrations < 2x QL if sample and/or field duplicate are $\leq$ 5x QL	Field Duplicate	S&A

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Sampling Procedure <sup>b</sup>	Analytical Method/SOP <sup>c</sup>	DQIs	Measurement Performance Criteria <sup>d</sup>	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
SW-19 (con't)	AP-1	Accuracy/Bias	70-130%	Alternate cleanup standards	A
	AP-1	Completeness	≥ 90%	Data Completeness Check	S&A

<sup>a</sup> PUF is treated as a solid matrix from the perspective of the laboratory's analytical methods. The PUF data are used to estimate dissolved concentrations in the water column.

<sup>b</sup> Refer to QAPP Worksheet #15 for a complete list of analytes for each analytical group

<sup>c</sup> Refer to QAPP Worksheet #21

<sup>d</sup> Refer to QAPP Worksheet #23

<sup>e</sup> Analyte specific limits may be found in the Laboratory SOP and HV Sampling SOP addendum located in Appendix B

<sup>f</sup> Field duplicates (as co-located samples) will be the only precision DQI for the HV solids samples. Laboratory duplicates are not possible, as the entire sample is required for the extraction, and cannot be split.

<b>Matrix</b>	Water				
<b>Analytical Group<sup>a</sup></b>	General Chemistry – POC				
<b>Concentration Level</b>	Low				
Sampling Procedure <sup>b</sup>	Analytical Method/SOP <sup>c</sup>	DQIs	Measurement Performance Criteria <sup>d</sup>	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
LPR-FI-04	C-16B	Accuracy/Bias-Contamination	<0.025 milligram/Liter (mg/L) or <10% of the concentration in the associated samples	MB	A
	C-16B	Accuracy/Bias-Contamination	No Target Compound >QL	Equipment Rinsate Blank	S&A
			95-105 percent recovery		



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	C-16B		(%R) or within the manufacturer's control limits if those limits are wider than 95-105%R	Laboratory Control Sample (LCS) <sup>f</sup>	
	C-16B	Accuracy/Bias	85-115%R	Laboratory Fortified Blank (LFB) <sup>g</sup>	A
	C-16B	Precision	RPD $\leq$ 20% if both samples are $>10\times$ QL	Laboratory Duplicate	A
	C-16B	Precision	RPD $\leq$ 30% if both samples are $>5\times$ QL or absolute difference between concentrations $<2\times$ QL if sample and/or field duplicate are $\leq 5\times$ QL	Field Duplicate <sup>e</sup>	S&A

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Sampling Procedure <sup>b</sup>	Analytical Method/SOP <sup>c</sup>	DQIs	Measurement Performance Criteria <sup>d</sup>	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
LPR-FI-04 (con't)	C-16B	Completeness	≥90%	Data Completeness Check	S&A

<sup>a</sup> Refer to QAPP Worksheet #15 for a complete list of analytes for each analytical group

<sup>b</sup> Refer to QAPP Worksheet #21

<sup>c</sup> Refer to QAPP Worksheet #23

<sup>d</sup> Analyte specific limits may be found in the Laboratory SOP located in Appendix B

<sup>e</sup> The field duplicate will consist of a second sample collected from the 20L carboy, filled concurrent with one of the sub-samples.

<sup>f</sup> The LCS will consist of a NIST SRM weighed and transferred to a blank filter prior to analysis. The solids LCS is not mixed with water.

<sup>g</sup> The LFB will consist of solid Organic Analytical Standard (OAS) in a tin capsule. The solids LCS is not mixed with water.

<b>Matrix</b>	Water				
<b>Analytical Group<sup>a</sup></b>	General Chemistry – DOC				
<b>Concentration Level</b>	Low				
Sampling Procedure <sup>b</sup>	Analytical Method/SOP <sup>c</sup>	DQIs	Measurement Performance Criteria <sup>d</sup>	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
LPR-FI-04	C-13, C-16B	Accuracy/Bias-Contamination	No target compound >QL	MB	A
	C-13, C-16B	Accuracy/Bias-Contamination	No target compound >QL	Equipment Rinsate Blank	S&A
	C-13, C-16B	Accuracy/Bias	90-109%R	LCS	A
	C-13, C-16B	Precision	RPD≤20%	LCS Duplicate (LCSD)	A
	C-13, C-16B	Accuracy/Bias	≤110% of the unspiked sample	Inorganic Carbon Spike	A
	C-13, C-16B	Accuracy/Bias	80-120%R	Matrix Spike (MS)	A
	C-13, C-16B	Precision	RPD≤20%	Matrix Spike Duplicate (MSD)	A

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	C-13, C-16B	Precision	RPD $\leq$ 30% if both samples are $>5\times$ QL or absolute difference between concentrations $<2\times$ QL if sample and/or field duplicate are $\leq 5\times$ QL	Field Duplicate <sup>e</sup>	S&A
	C-13, C-16B	Completeness	$\geq 90\%$	Data Completeness Check	S&A

<sup>a</sup> Refer to QAPP Worksheet #15 for a complete list of analytes for each analytical group

<sup>b</sup> Refer to QAPP Worksheet #21

<sup>c</sup> Refer to QAPP Worksheet #23

<sup>d</sup> Analyte specific limits may be found in the Laboratory SOP located in Appendix B

<sup>e</sup> The field duplicate will consist of a second sample collected from the 20L carboy, filled concurrent with one of the sub-samples.

<b>Matrix</b>	Water				
<b>Analytical Group<sup>a</sup></b>	General Chemistry – SSC				
<b>Concentration Level</b>	Low				
<b>Sampling Procedure<sup>b</sup></b>	<b>Analytical Method/SOP<sup>c</sup></b>	<b>DQIs</b>	<b>Measurement Performance Criteria<sup>d</sup></b>	<b>QC Sample and/or Activity Used to Assess Measurement Performance</b>	<b>QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&amp;A)</b>
LPR-FI-04	C-17	Accuracy/Bias-Contamination	No target compound $>QL$	MB	A
	C-17	Accuracy/Bias-Contamination	No target compound $>QL$	Equipment Rinsate Blank	S & A
	C-17	Precision	RPD $\leq 20\%$	Laboratory Duplicate	A
	C-17	Precision	RPD $\leq 30\%$ if both samples are $>5\times$ QL or absolute difference between concentrations $<2\times$ QL if sample and/or field duplicate are $\leq 5\times$ QL	Field Duplicate <sup>e</sup>	S & A
	C-17	Completeness	$\geq 90\%$	Data Completeness Check	S & A



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### ***QAPP Worksheet #12 (UFP-QAPP Manual Section 2.6.2) Measurement Performance Criteria Table***

- <sup>a</sup> Refer to QAPP Worksheet #15 for a complete list of analytes for each analytical group
- <sup>b</sup> Refer to QAPP Worksheet #21
- <sup>c</sup> Refer to QAPP Worksheet #23
- <sup>d</sup> Analyte specific limits may be found in the Laboratory SOP located in Appendix B
- <sup>e</sup> The field duplicate will consist of a second sample collected from the 20L carboy, filled concurrent with one of the sub-samples.

Secondary Data	Data Source (Originating Organization, Report Title, and Date)	Data Generator(s) (Originating Org., Data Types, Data Generation/Collection Dates)	How Data Will Be Used	Limitations on Data Use
<b>Work Performed by Tierra Solutions, Inc. in LPRSA</b>				
Tide Gage Measurement	Tierra Solutions, Inc. 1995 to 1996 Sediment Sampling and Source Identification Program: Inventory and Overview Report of Historical Data: Revision 0 Appendix I. Tierra Solutions Inc. June 2004.	Tierra Solutions, Inc., Water level fluctuations, April 14, 1995 to June 11, 1996 (partial), 3 gages RM: 0.9–7.8	Provides characterization of water level variation.	Does not cover all flow conditions. Covers only RM 0.9 – 7.8. Does not include concurrent water quality data. See PWCM QAPP (AECOM 2010a) for data quality review.
Current Cross-Section Measurement	Tierra Solutions, Inc. 1995 to 1996 Sediment Sampling and Source Identification Program: Inventory and Overview Report of Historical Data: Revision 0 Appendix I. Tierra Solutions Inc. June 2004.	Tierra Solutions, Inc., 8 Velocity cross-sections periodically surveyed between July 7, 1995 and May 22, 1996 during different tide phases RM: 0.5–7.9	Provides characterization under limited set of conditions.	Does not cover all flow conditions. Covers only RM 0.5 – 7.9. Does not include concurrent water quality data. See PWCM QAPP (AECOM 2010a) for data quality review.
Moored Current Profile Measurement	Tierra Solutions, Inc. 1995 to 1996 Sediment Sampling and Source Identification Program: Inventory and Overview Report of Historical Data: Revision 0 Appendix I. Tierra Solutions Inc. June 2004.	Tierra Solutions, Inc., Point velocity meters, July 26, 1995 to May 22, 1996 (partial), 3 gages RM: 1.4–6.8	Provides characterization under limited set of conditions.	Does not cover all flow conditions. Covers only RM 1.4 – 6.8. Does not include concurrent water quality data. See PWCM QAPP (AECOM 2010a) for data quality review.
Salinity Cross-Section Measurement	Tierra Solutions, Inc. 1995 to 1996 Sediment Sampling and Source Identification Program: Inventory and Overview Report of Historical Data: Revision 0 Appendix I. Tierra Solutions Inc. June 2004.	Tierra Solutions, Inc., 8 Salinity cross-sections periodically surveyed between July 20, 1995 and May 22, 1996, during different tide phases RM: 0.5–7.9	Provides characterization under limited set of conditions.	Does not capture movement of salt wedge with flow conditions. Does not include concurrent water quality data. See PWCM QAPP (AECOM 2010a) for data quality review.
<b>Work Performed by MPI in LPRSA</b>				
Moored Current Profile Measurement	MPI 2004 to 2005 No Formal Report <a href="http://www.ourpassaic.org">www.ourpassaic.org</a> Accessed January 20, 2008.	MPI, Vertical velocity profile, November 2, 2004, to October 11, 2005 (partial), 3 gages RM: 8.6–11.5	Provides characterization under limited set of conditions.	Dataset is incomplete with substantial time periods and spatial locations not included. See PWCM QAPP (AECOM 2010a) for data quality review.
Moored Salinity Measurement	MPI 2004 to 2005 No Formal Report <a href="http://www.ourpassaic.org">www.ourpassaic.org</a> Accessed January 20, 2008.	MPI, surface and bottom salinity conditions, November 30, 2004 to September 20, 2005, 3 gages RM: 8.6–11.5	Provides characterization under limited set of conditions.	Meters present only between RM 8.6 and RM 11.5. See PWCM QAPP (AECOM 2010a) for data quality review.

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Moored Turbidity Measurement	MPI 2004 to 2005 No Formal Report <a href="http://www.ourpassaic.org">www.ourpassaic.org</a> Accessed January 20, 2008.	MPI, surface and bottom suspended solids conditions, November 30, 2004 to September 20, 2005 (partial), 3 gages RM: 8.6–11.5	Provides characterization under limited set of conditions.	Meters present only between RM 8.6 and RM 11.5. See PWCM QAPP (AECOM 2010a) for data quality review.
Dissolved/total metals, Dissolved/particulate PCBs, pesticides, POC, DOC, Chlorine (Cl), Bromine (Br), Total Suspended Solids (TSS)	MPI, pilot dredging study Passaic River Estuary Management Information System (PREmis) database	Collected December 2005 in Harrison Reach only.	Provides characterization under limited set of conditions.	Very limited temporal or spatial coverage or limited/lacking corresponding hydrodynamic information.
PCDD/Fs, pesticides, PCBs, TSS	MPI, Hydrophobic Organic Compound Sampling Method Validation Study (HSMVS) survey project PREmis database	Collected October/November 2005	Provides preliminary data on ranges of concentrations, evaluation of sampling methodology.	Limited temporal and spatial coverage.
Metals, pesticides, Volatile Organic Compounds (VOCs), SVOCs, herbicides, nutrients, Biological Oxygen Demand (BOD), DOC, Chlorophyll a, TSS	MPI Small Volume Composite Grab (SVCG) survey project PREmis database	Collected November 2005	Provides preliminary data on ranges of concentrations, evaluation of sampling methodology.	Limited temporal and spatial coverage.
Empirical Mass Balance Model (EMBM) Sampling Program - Water Column Suspended Sediment Sampling on Tributaries and Upper Passaic River	PREmis database	Collected Winter 2008	Provides preliminary data on ranges of concentrations, evaluation of sampling methodology	Limited temporal and spatial coverage. No report available providing methodology.
Work Performed by Rutgers University Coastal Ocean Observation Lab in LPRSA and/or NBSA				

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Moored Salinity Measurement	Rutgers 2004 to 2005 No Formal Report <a href="http://www.marine.rutgers.edu/cool/passaic/">www.marine.rutgers.edu/cool/passaic/</a> Accessed January 20, 2008	Rutgers, surface and bottom salinity, August 18, 2004 to September 12, 2005, 5 moorings RM: 1.0–7.8	Provides characterization under limited set of conditions	Does not cover all flow conditions. See PWCM QAPP (AECOM 2010a) for data quality review.
Moored Current Profile Measurement	Rutgers 2004 to 2005 No Formal Report <a href="http://www.marine.rutgers.edu/cool/passaic/">www.marine.rutgers.edu/cool/passaic/</a> Accessed January 20, 2008	Rutgers, Vertical velocity profile, August 18, 2004 to September 3, 2005 RM: 2.8	Provides insight to appropriate mooring locations for future synoptic data	Available for single location at approximately RM 3. See PWCM QAPP (AECOM 2010a) for data quality review.
Salinity Profile Transect Measurement	Rutgers 2004 to 2005 No Formal Report <a href="http://www.marine.rutgers.edu/cool/passaic/">www.marine.rutgers.edu/cool/passaic/</a> Accessed January 20, 2008	Rutgers, 13 Salinity transects, June 23, 2004 to August 18, 2005. RM: 0.0–8.0	Provides characterization under limited set of conditions	Covers only lower 8 miles of river. Synoptic nature of data unconfirmed. See PWCM QAPP (AECOM 2010a) for data quality review.
Current Profile Transect Measurement	Rutgers 2004 to 2005 No Formal Report <a href="http://www.marine.rutgers.edu/cool/passaic/">www.marine.rutgers.edu/cool/passaic/</a> Accessed January 20, 2008	Rutgers, Velocity cross-section, September 23, 2004 to August 18, 2005, 13 transects RM: 0.0–8.0	Will not be used	Data not corrected for magnetic influence on instrumentation compass, or used to monitor dye study, therefore not synoptic. See PWCM QAPP (AECOM 2010a) for data quality review.
Moored Turbidity Measurement	Rutgers 2004 to 2005 No Formal Report <a href="http://www.marine.rutgers.edu/cool/passaic/">www.marine.rutgers.edu/cool/passaic/</a> Accessed January 20, 2008	Rutgers, surface and bottom suspended solids conditions, August 18, 2004 to September 12, 2005 (partial), 5 moorings RM: 1.0–6.7	Will not be used	Substantial instrumentation fouling due to debris in river. See PWCM QAPP (AECOM 2010a) for data quality review.
Moored Turbidity Measurement	Rutgers 2004 to 2005 No Formal Report <a href="http://www.marine.rutgers.edu/cool/passaic/">www.marine.rutgers.edu/cool/passaic/</a> Accessed January 20, 2008	Rutgers, Vertical turbidity profile, August 18, 2004 – September 3, 2005 RM: 2.8	Provides characterization under limited set of conditions	Data available only for RM 3. See PWCM QAPP (AECOM 2010a) for data quality review.

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Moored Acoustic Doppler Current Profiler (ADCP) Measurements	Sommerfield and Chant 2010	Sommerfield and Chant, April 2008 – March 2009. 5 moorings: LPR, Hackensack River, mid-Newark Bay, Kill van Kull, Arthur Kill	Characterization of flows, salinity and solids movement in the NBSA	Covers a range of flow events, but the complete set of concurrent turbidity data (for estimating loads into and out of the system) was not recovered.
Moored Turbidity Measurements	Sommerfield and Chant 2010	Sommerfield and Chant, April 2008 – March 2009. 5 moorings: LPR, Hackensack River, mid-Newark Bay, Kill van Kull, Arthur Kill	Characterization of flows, salinity and solids movement in the NBSA	Surface turbidity data in the Kills was corrected due to fouling, limiting the ability to use the data in model development.
Water Column TSS	Sommerfield and Chant 2010	Sommerfield and Chant, April 2008 – March 2009. Collected along transects at the locations of the 5 moorings: LPR, Hackensack River, mid-Newark Bay, Kill van Kull, Arthur Kill	Characterization of flows, salinity and solids movement in the NBSA	Data will be reviewed for quality, completeness and sufficiency for NBSA characterization when publically available
<b>Work performed by various investigators in LPRSA and/or NBSA</b>				
Stream Flow	United States Geological Survey (USGS) Gage 01389500 – Passaic River at Little Falls, NJ No Formal Report <a href="http://waterdata.usgs.gov/nj/nwis/nwisman/?site_no=01389500&amp;agency_cd=USGS">http://waterdata.usgs.gov/nj/nwis/nwisman/?site_no=01389500&amp;agency_cd=USGS</a>	USGS Daily average stream flow August 1897 – present	Record of historical flows, development of flow frequency statistics, and evaluation of other water column measurements	No limitations
Stream Flow	USGS Gage 01389890 – Passaic River at Dundee Dam at Clifton, NJ No Formal Report <a href="http://waterdata.usgs.gov/nj/nwis/inventory/?site_no=01389890&amp;agency_cd=USGS">http://waterdata.usgs.gov/nj/nwis/inventory/?site_no=01389890&amp;agency_cd=USGS</a>	USGS Daily average stream flow April 2007 – present	Evaluation of other water column measurements, compare with Little Falls data	Limited record

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## QAPP Worksheet #13 (UFP-QAPP Manual Section 2.7) Secondary Data Criteria and Limitations Table

Various Water Quality Parameters	Tierra Solutions, Inc. (2004) for a complete summary of historic data collection programs	Various public and private entities	Data provides historic context, but no direct application.	Limited spatial and temporal extent, potentially dated laboratory methods, many studies not performed to CERCLA standards.
HOCS, Metals, carbon, TSS and ancillary (loading) data	NY/NJ HEP (2004) CARP program. See NY/NJ HEP website <a href="http://www.carpweb.org/main.html">http://www.carpweb.org/main.html</a> .	Same as data source	Limited use of NY/NJ HEP data for comparative purposes only.	Very limited temporal or spatial coverage or limited/lacking corresponding hydrodynamic information. The data are considered too variable and uncertain to provide reliable and useful partition coefficients for the LPR/NB CFT model.
<b>Work performed by CPG and Tierra Solution, Inc. in LPRSA and NBSA</b>				
Physical water quality data including SSC, POC, and DOC	No report to date. Work conducted per PWCM QAPP (AECOM, 2010a)	CPG and Tierra Solutions, Inc. Water samples collected 2009-2010 under various flow conditions.	SSC data will be reviewed to determine approximate solids load in the water column at various locations in LPRSA and NBSA.	Use data with the recognition that laboratory and/or validation qualifiers may impose limitations on specific datasets and/or data points.
SV chemical water samples including HOCS, metals, SSC, POC, and DOC	CPG and Tierra Solutions, Inc. <ul style="list-style-type: none"> <li>• Routine Event #1. August 2011.</li> <li>• Routine Event #2. February 2012.</li> <li>• Routine Event #3. March 2012.</li> <li>• Routine Event #4, June 2012.</li> <li>• Routine Events #5 and #6. Dates pending.</li> <li>• Low Flow/Spring Tide Event. August 2012.</li> <li>• High Flow sampling event(s) pending.</li> </ul>	CPG and Tierra Solutions, Inc. Water samples collected 2011-2012 under various flow conditions per SV CWCM QAPP (AECOM, 2011a)	SSC data will be reviewed to determine approximate solids load in the water column at various locations in LPRSA and NBSA. HOC data reviewed to estimate relative concentrations of HOCS.	Use data with the recognition that laboratory and/or validation qualifiers may impose limitations on specific datasets and/or data points.



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***QAPP Worksheet #13 (UFP-QAPP Manual Section 2.7) Secondary Data Criteria and Limitations Table***

**Sampling Tasks:** Sample collection is planned at two locations in the LPRSA (Tidal River 2 (or RM 4.2) and RM 10.2), and two locations in NBSA (NB South and NB Northeast). These locations were chosen to be representative of the various salinity regimes in the LPRSA and NBSA such that the partition coefficients to be derived using these data are representative of low and high salinity gradients in each study area. In addition, one location in each area will be sampled as representative of boundary conditions: above Dundee Dam for LPRSA and at Kill Van Kull for NBSA. Samples will be collected from each location at one depth (mid-water column above Dundee Dam and 3 feet [ft] from the bottom for other stations) to provide a sample representative of the location. Sampling may occur any time during the year, but at flows consistent with the SV CWCM Routine Events (400 – 3,000 cfs at Dundee Dam). These sampling locations will provide data that represent the “normal” flow condition in the river.

The HV sampling will be conducted using a PR2900 sampling system designed by Gravity Environmental. Details of the field sampling methods are provided in the field SOPs (Appendix A). The PR2900 uses a peristaltic pump with Teflon-lined dedicated tubing to draw water through a vortex solids separation system with a 0.7 um flat laboratory grade glass fiber filter to capture remaining solids. Due to the high concentrations of neutrally buoyant algae-like particles observed in the LPR, a pre-filter will likely be employed during the HV sampling in the LPRSA and NBSA. This pre-filter, used to separate the large neutrally buoyant particles, will consist of stainless steel cartridges packed with laboratory-cleaned glass wool placed in-line prior to the vortex chamber when readings on the LISST indicate the presence of large particles (see SOP SW-19). The solids captured in the separation system and the solids on the flat filter and in the glass wool are combined to represent the particulate phase sample. The water is then passed through PUF sorption medium cartridge(s) to capture organic analytes in the filtrate. Flow rates are low (approximately 1.5 L/min) to avoid clogging of the filters and maximize analyte capture (refer to Appendix A, Field SOPs). To meet the ultra-low detection limits required for the PCDD/Fs and PCBs (see Worksheet #15) and collect enough solids from the water column to obtain a sample, it is necessary to sample large volumes of water over several hours.

Non-HOC constituents (POC, DOC and SSC) will be sampled throughout the PCDD/F and PCB sampling time duration using the same equipment used during SV CWCM program (see Appendix A). These time weighted-composite samples will be collected into 20 L carboys situated on a magnetic stir plate. At the conclusion of the HV sampling period at each location, four time weighted-composite sub-samples for each non-HOC constituent will be collected from the 20 L carboy using a peristaltic pump and dedicated tubing. The four results reported from the laboratory will be reported as an average concentration in the EDD, with the error (1 sigma) noted. The individual results will also be included in the EDDs, but will be noted as “Not Reportable” or other notation to be determined that indicates the result is of a sub-sample and not the average concentration used in the calculations presented in Worksheet #37.

From each location, six samples will be collected consisting of: (1) one HV sample of solids separated and filters from the water column to be analyzed for PCBs (congeners and homologs) and PCDD/Fs; (2) one HV sample of PUF sorption medium (two PUF cartridges for the first HV sampling event) through which the filtrate has been passed (representative of the dissolved fraction) to be analyzed for PCBs (congeners and homologs) and PCDD/Fs; and (3) four time-weighted composite sub-samples of whole water for analyses of POC, DOC and SSC.

One round of sampling will initially be conducted to fulfill the objectives of the HV sampling program. Samples from the first HV sampling event will be submitted for rapid turnaround analyses (i.e., 30 day turnaround). The CPG will review the HV data and discuss them with USEPA, and additional sampling rounds will be conducted, if warranted.

**Analytical Tasks:** The separated solids and sorption medium (PUF) samples will be analyzed for PCB congeners and homologs and PCDD/Fs to characterize the particulate and dissolved phase concentrations of contaminants in surface water, to estimate partition coefficients in the LPRSA and



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### ***QAPP Worksheet #14 (UFP-QAPP Manual Section 2.8.1) Summary of Project Tasks***

NBSA, and to estimate concentrations in boundary conditions of the LPRSA and NBSA. The time-weighted composite sub-samples will be analyzed for SSC to evaluate concentrations of PCB congeners and homologs and PCDD/Fs in the particulate phase of the water, as well as DOC and POC, to aid in the calculation of the partition coefficients for the CFT model.

**QC Tasks:** QC samples have been defined for the field and laboratory efforts. Field QC samples are summarized on Worksheet #20; laboratory QC samples are summarized on Worksheet #28.

**Secondary Data:** All relevant secondary/historical data are summarized on Worksheet #13.

**Data Management Tasks:** AECOM's DMP (AECOM, 2010b) covers all field-collected and laboratory-generated records/data. The handling of records and data is summarized on Worksheet #29.

**Documentation and Records:** Project related records (field, sample transfer/COC, laboratory) are summarized on Worksheet #29.

**Assessment/Audit Tasks:** Field and laboratory audits are scheduled in accordance with Worksheet #31.

**Data Review Tasks:** Field data will be reviewed as described in Worksheet #34. Laboratories are contractually required to verify all laboratory data including EDDs as summarized in Worksheet #34. Data validation and usability assessments will be conducted as detailed in Worksheets #35, 36, and 37.

**Matrix:** Solids

**Analytical Group:** PCBs – Homologs and Congeners; Method 1668A; Analytical Perspectives, Wilmington, NC

**Concentration Level:** Low

Analyte	CAS Number	PAL (picograms [pg]/sample) <sup>a</sup>	Project QL Goal (pg/sample)	Analytical Method <sup>b</sup>		Achievable Laboratory Limits <sup>c</sup>	
				Method Detection Limits (MDLs) (pg/g)	Method EMLs (pg/g)	EDLs (pg/sample)	EMLs (pg/sample)
Monochlorobiphenyl	27323-18-8	25	25	NA	NA	NA	25
Dichlorobiphenyl	25512-42-9	50	50	NA	NA	NA	50
Trichlorobiphenyl	25323-68-6	25	25	NA	NA	NA	25
Tetrachlorobiphenyl	26914-33-0	25	25	NA	NA	NA	25
Pentachlorobiphenyl	25429-29-2	25	25	NA	NA	NA	25
Hexachlorobiphenyl	26601-64-9	25	25	NA	NA	NA	25
Heptachlorobiphenyl	28655-71-2	25	25	NA	NA	NA	25
Octachlorobiphenyl	55722-26-4	25	25	NA	NA	NA	25
Nonachlorobiphenyl	53742-07-7	25	25	NA	NA	NA	25
Decachlorobiphenyl	2051-24-3	25	25	NA	NA	NA	25
PCB 1	2051-60-7	10	10	80	200	8.0	10
PCB 2	2051-61-8	10	10	4.0	10	9.0	10
PCB 3	2051-62-9	10	10	90	200	0.95	10
PCB 4	13029-08-8	50	50	170	500	11	50
PCB 5	16605-91-7	50	50	10	50	13	50
PCB 6	25569-80-6	10	10	10	50	9.0	10
PCB 7	33284-50-3	50	50	20	50	12	50
PCB 8	34883-43-7	10	10	120	500	9.6	10
PCB 9	34883-39-1	50	50	20	50	10	50
PCB 10	33146-45-1	50	50	20	50	13	50
PCB 11	2050-67-1	40	40	100	200	19	40
PCB 12+ PCB 13	2974-92-7; 2974-90-5	50	50	30	100	11	50
PCB 14	34883-41-5	50	50	30	100	12	50
PCB 15	2050-68-2	10	10	180	500	0.63	10
PCB 16	38444-78-9	10	10	40	100	1.9	10
PCB 17	37680-66-3	10	10	90	200	3.3	10
PCB 18 + PCB 30	37680-65-2; 35693-92-6	50	50	170	500	12	50
PCB 19	38444-73-4	10	10	40	100	2.8	10



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PCB 20 + PCB 28	38444-84-7; 7012-37-5	80	80	190	500	24	80
PCB 21 + PCB 33	55702-46-0; 38444-86-9	50	50	50	200	11	50
PCB 22	38444-85-8	10	10	90	200	4.6	10
PCB 23	55720-44-0	10	10	50	200	3.7	10
PCB 24	55702-45-9; 38444-76-7	10	10	50	200	2.8	10
PCB 25	55712-37-3	10	10	50	200	1.3	10
PCB 26 + PCB 29	38444-81-4; 15862-07-4	10	10	80	200	0.54	10
PCB 27	38444-76-7	10	10	60	200	2.1	10
PCB 31	16606-02-3	50	50	150	500	16	50
PCB 32	38444-77-8	10	10	80	200	3.5	10
PCB 34	37680-68-5	10	10	70	200	3.3	10
PCB 35	37680-69-6	10	10	80	200	2.7	10
PCB 36	38444-87-0	10	10	80	200	3.0	10
PCB 37	38444-90-5	10	10	130	500	3.6	10
PCB 38	53555-66-1	10	10	80	200	3.6	10
PCB 39	38444-88-1	10	10	90	200	3.0	10
PCB 40 + PCB 71	38444-93-8; 41464-46-4	10	10	120	500	0.57	10
PCB 41	52663-59-9	10	10	120	500	3.2	10
PCB 42	36559-22-5	10	10	60	200	1.6	10
PCB 43	70362-46-8	10	10	90	200	4.2	10
PCB 44 + PCB 47 + PCB 65	41464-39-5; 2437-79-8; 33284-54-7	10	10	190	500	9.9	10
PCB 45	70362-45-7	10	10	50	200	2.8	10
PCB 46	41464-47-5	10	10	100	200	3.7	10
PCB 48	70362-47-9	10	10	80	200	1.5	10



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PCB 49 + PCB 69	41464-40-8; 60233-24-1	10	10	110	500	4.0	10
PCB 50 + PCB 53	62796-65-0; 41464-41-9	10	10	60	200	2.0	10
PCB 51	68194-04-7	10	10	60	200	3.2	10
PCB 52	35693-99-3	50	50	190	500	13	50
PCB 54	15968-05-5	10	10	120	500	2.8	10
PCB 55	74338-24-2	10	10	120	500	3.2	10
PCB 56	41464-43-1	10	10	100	200	0.18	10
PCB 57	70424-67-8	10	10	120	500	3.5	10
PCB 58	41464-49-7	10	10	130	500	3.1	10
PCB 59 + PCB 62 + PCB 75	74472-33-6; 54230-22-7; 32598-12-2	10	10	60	200	2.3	10
PCB 60	33025-41-1	10	10	130	500	1.5	10
PCB 61 + PCB 70 + PCB 74 + PCB 76	33284-53-6; 32598-11-1; 32690-93-0; 70362-48-0	50	50	170	500	11	50
PCB 63	74472-34-7	100	100	140	500	31	100
PCB 64	52663-58-8	10	10	70	200	1.6	10
PCB 66	32598-10-0	10	10	160	500	3.6	10
PCB 67	73575-53-8	10	10	150	500	2.8	10
PCB 68	73575-52-7	10	10	150	500	3.2	10
PCB 72	41464-42-0	10	10	160	500	3.1	10
PCB 73	74338-23-1	10	10	170	500	2.9	10
PCB 77	32598-13-3	10	10	170	500	3.0	10
PCB 78	70362-49-1	10	10	170	500	3.3	10
PCB 79	41464-48-6	10	10	170	500	2.8	10
PCB 80	33284-52-5	10	10	180	500	3.2	10
PCB 81	70362-50-4	10	10	180	500	3.7	10



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PCB 82	52663-62-4	10	10	130	500	3.7	10
PCB 83	60145-20-2	10	10	220	500	4.1	10
PCB 84	52663-60-2	10	10	120	500	2.1	10
PCB 85 + PCB 116	65510-45-4; 18259-05-7	10	10	100	200	3.0	10
PCB 86 + PCB 87 + PCB 97 + PCB 108 + PCB 119 + PCB 125	55312-69-1; 38380-02-8; 41464-51-1; 70362-41-3; 56558-17-9; 74472-39-2	10	10	270	1000	1.9	10
PCB 88	55215-17-3	100	100	120	500	4.9	100
PCB 89	73575-57-2	10	10	190	500	4.0	10
PCB 90 + PCB 101 + PCB 113	68194-07-0; 37680-73-2; 68194-10-5	10	10	240	1000	5.4	10
PCB 91	68194-05-8	10	10	120	500	2.8	10
PCB 92	52663-61-3	10	10	120	500	3.0	10
PCB 93 + PCB 100	73575-56-1; 39485-83-1	10	10	220	500	3.8	10
PCB 94	73575-55-0	10	10	220	500	4.6	10
PCB 95	38379-99-6	10	10	220	500	5.0	10
PCB 96	73575-54-9	10	10	210	500	2.9	10
PCB 98	60233-25-2	100	100	220	500	3.9	100
PCB 99	38380-01-7	10	10	220	500	0.49	10
PCB 102	68194-06-9	10	10	220	500	3.8	10
PCB 103	60145-21-3	10	10	230	500	3.4	10
PCB 104	56558-16-8	10	10	230	500	3.0	10
PCB 105	32598-14-4	10	10	110	20	1.0	10
PCB 106	70424-69-0	10	10	140	500	3.0	10



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PCB 107 + PCB 124	70424-68-9; 70424-70-3	10	10	270	1000	3.0	10
PCB 109	74472-35-8	10	10	150	500	2.5	10
PCB 110	38380-03-938-1	10	10	240	1000	4.6	10
PCB 111	39635-32-0	10	10	240	1000	3.2	10
PCB 112	74472-36-9	10	10	250	1000	2.9	10
PCB 114	74472-37-0	10	10	120	500	3.1	10
PCB 115	74472-38-1	10	10	240	1000	2.7	10
PCB 117	68194-11-6	10	10	100	200	3.1	10
PCB 118	31508-00-6	10	10	190	500	3.3	10
PCB 120	68194-12-7	10	10	150	500	2.8	10
PCB 121	56558-18-0	10	10	210	500	3.2	10
PCB 122	76842-07-4	10	10	120	500	3.3	10
PCB 123	65510-44-3	10	10	150	500	3.4	10
PCB 126	57465-28-8	10	10	140	500	3.4	10
PCB 127	39635-33-1	10	10	280	1000	3.2	10
PCB 128 + PCB 166	38380-07-3; 41411-63-6	10	10	120	500	3.3	10
PCB 129 + PCB 138 + PCB 163	55215-18-4; 56030-56-9; 74472-44-9	10	10	210	500	2.7	10
PCB 130	52663-66-8	10	10	140	500	3.8	10
PCB 131	61798-70-7	10	10	120	500	3.4	10
PCB 132	52704-70-8	10	10	120	500	2.4	10
PCB 133	35694-04-3	10	10	170	500	3.6	10
PCB 134	52744-13-5	10	10	130	500	3.9	10
PCB 135 + PCB 151	52744-13-5; 52663-63-5	10	10	110	500	2.1	10
PCB 136	38411-22-2	10	10	90	200	2.0	10
PCB 137	35694-06-5	10	10	300	1000	3.5	10



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PCB 139 + PCB 140	56030-56-9; 59291-64-4	10	10	200	500	3.4	10
PCB 141	52712-04-6	10	10	90	200	2.6	10
PCB 142	41411-61-4	10	10	310	1000	4.0	10
PCB 143	68194-15-0	10	10	130	500	3.7	10
PCB 144	68194-14-9	10	10	170	500	3.2	10
PCB 145	74472-40-5	10	10	320	1000	2.8	10
PCB 146	51908-16-8	10	10	180	500	2.6	10
PCB 147 + PCB 149	68194-13-8; 38380-04-0	10	10	180	500	1.1	10
PCB 148	74472-41-6	10	10	320	1000	3.6	10
PCB 150	68194-08-1	10	10	330	1000	2.9	10
PCB 152	68194-09-2	80	80	240	1000	2.5	80
PCB 153 + PCB 168	35065-27-1; 59291-65-5	10	10	130	500	3.7	10
PCB 154	60145-22-4	10	10	110	500	2.9	10
PCB 155	33979-03-2	10	10	340	1000	2.7	10
PCB 156 + PCB 157	38380-08-4; 69782-90-7	10	10	130	500	4.1	10
PCB 158	74472-42-7	10	10	100	200	2.2	10
PCB 159	39635-35-3	10	10	350	1000	3.0	10
PCB 160	41411-62-5	10	10	210	500	2.9	10
PCB 161	74472-43-8	10	10	350	1000	2.7	10
PCB 162	39635-34-2	10	10	350	1000	3.3	10
PCB 164	74472-45-0	10	10	140	500	2.3	10
PCB 165	74472-46-1	10	10	360	1000	2.8	10
PCB 167	52663-72-6	10	10	110	500	3.3	10
PCB 169	32774-16-6	10	10	160	500	3.9	10
PCB 170	35065-30-6	10	10	160	500	4.0	10



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PCB 171 + PCB 173	52663-71-5; 68194-16-1	10	10	370	1000	4.0	10
PCB 172	52663-74-8	10	10	380	1000	4.1	10
PCB 174	38411-25-5	10	10	390	1000	3.3	10
PCB 175	40186-70-7	10	10	390	1000	4.1	10
PCB 176	52663-65-7	10	10	390	1000	2.9	10
PCB 177	52663-70-4	10	10	140	500	3.9	10
PCB 178	52663-67-9	10	10	220	500	3.4	10
PCB 179	52663-64-6	10	10	230	500	2.4	10
PCB 180 + PCB 193	35065-29-3; 69782-91-8	10	10	140	500	0.28	10
PCB 181	74472-47-2	10	10	400	1000	4.2	10
PCB 182	60145-23-5	10	10	400	1000	3.7	10
PCB 183	52663-69-1	10	10	400	1000	3.1	10
PCB 184	74472-48-3	10	10	400	1000	2.8	10
PCB 185	52712-05-7	10	10	400	1000	4.5	10
PCB 186	74472-49-4	10	10	410	1000	2.7	10
PCB 187	52663-68-0	10	10	190	500	2.0	10
PCB 188	74487-85-7	10	10	230	500	2.9	10
PCB 189	39635-31-9	10	10	180	500	3.2	10
PCB 190	41411-64-7	10	10	230	500	3.2	10
PCB 191	74472-50-7	10	10	420	1000	3.3	10
PCB 192	74472-51-8	10	10	420	1000	3.3	10
PCB 194	35694-08-7	10	10	170	500	3.8	10
PCB 195	52663-78-2	10	10	430	1000	4.4	10
PCB 196	42740-50-1	10	10	430	1000	3.6	10
PCB 197	33091-17-7	10	10	250	1000	2.6	10
PCB 198 + PCB 199	68194-17-2; 52663-75-9	10	10	200	500	3.6	10
PCB 200	52663-73-7	10	10	250	1000	3.1	10



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PCB 201	40186-71-8	10	10	440	1000	2.9	10
PCB 202	2136-99-4	10	10	440	1000	3.3	10
PCB 203	52663-76-0	10	10	440	1000	3.3	10
PCB 204	74472-52-9	10	10	450	1000	3.0	10
PCB 205	74472-53-0	10	10	450	1000	4.0	10
PCB 206	40186-72-9	10	10	450	1000	8.0	10
PCB 207	52663-79-3	10	10	450	1000	5.9	10
PCB 208	52663-77-1	10	10	460	1000	6.9	10
PCB 209	2051-24-3	10	10	150	500	1.7	10

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- <sup>a</sup> PALs based on QLs derived from the low point of calibration or laboratory EMLs if the EML is elevated above the QL. Most laboratory EMLs are equivalent to the QLs. Note PALs are not risk based for this program but are equivalent to the QL/EMLs because laboratory results are reported on a pg/sample basis.
- <sup>b</sup> Analytical MDLs and EMLs are those documented in validated methods, modified for a 1 gram (g) sample size. "NA" indicates that MDL and/or EML values were not included in the validated methods.
- <sup>c</sup> Achievable EDLs (derived from annual averaged field sample and QC sample EDLs) and QL or EMLs are limits that an individual laboratory can achieve when performing a specific analytical method and are typically based on whole samples as received. Actual EDLs and QL or EMLs will vary based on sample-specific factors. All results between the EDL and QL or EML will be reported as estimated values (J qualifier). Reporting limits (RLs) (i.e., the numerical values associated with non-detects) for the individual congeners will be based on sample-specific EDLs rather than QL or EMLs. Laboratory results will be reported in pg/sample, rather than pg/g. These limits are applicable to both the particulate solids and PUF fraction which is treated as a solid during extraction and analysis. The final EDD will contain both the laboratory reported values (pg/sample) and values converted by AECOM to pg/L for dissolved phase and pg/g for separated solids. "NA" indicates that EDLs are not applicable for the associated compounds. Matrix interference can increase EDLs by as much as a factor of 10-fold, but common laboratory contaminants are not expected to significantly impact the laboratory sensitivity goals.

The volume of water to be sampled is dependent on the mass of suspended sediment at each station, as measured during Routine Event #1 and Routine Event #2 of the SV CWCM program. The volume of water sampled is calculated assuming 1g of solids may be separated assuming the lower end of the SSC from the SV CWCM data, with a buffer of 1g (2g solids total to be removed), rounded up to the nearest 25 L. Refer to Worksheet #37 for details on the data usability assessment with regard to sensitivity and calculations using SSC data and flow volume.

Estimated example volumes for each station are provided below. These estimated volume sampled will be modified based on all data available from the preceding SV CWCM sampling events. The field records will include the proposed sampling volume per the HV CWCM QAPP, modified proposed sampling volume (including assumptions and calculations, if required), and the actual sample volume collected.

Location	SSC <sup>[1]</sup> (mg/L)	Date SSC Measured	Volume to achieve 2g solid at known SSC <sup>[2]</sup>	Pumping Time <sup>[3]</sup>
Above Dundee Dam	2.5	2/20/2012	2,000 milligrams (mg) solid ÷ 2.5 mg SSC / L = 800 L Proposed estimated sampling volume = 800 L	800L ÷ 1.5 L/min = 533 min 533 min ÷ 60 min/hr = 9 hr
RM 10.2	3.1	2/20/2012	2,000 mg solid ÷ 3.1 mg SSC / L = 645 L Proposed estimated sampling volume = 650 L	650L ÷ 1.5 L/min = 433 min 433 min ÷ 60 min/hr = 7.5 hr
RM 4.2 (Tidal 2)	11.9	2/21/2012	2,000 mg solid ÷ 11.9 mg SSC / L = 168 L Proposed estimated sampling volume = 175 L	175L ÷ 1.5 L/min = 117 min 117 min ÷ 60 min/hr = 2 hr
Kill van Kull	5.1	8/17/2011	2,000 mg solid ÷ 5.1 mg SSC / L = 392 L Proposed estimated sampling volume = 400 L	400L ÷ 1.5 L/min = 267 min 267 min ÷ 60 min/hr = 4.5 hr
NB South	4.9	8/18/2011	2,000 mg solid ÷ 4.9 mg SSC / L = 408 L Proposed estimated sampling volume = 425 L	425L ÷ 1.5 L/min = 283 min 283 ÷ 60 min/hr = 5 hr



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NB Northeast	8.9	2/22/2012	2,000 mg solid + 8.9 mg SSC / L = 224 L Proposed estimated sampling volume = 225 L	225L + 1.5 L/min = 150 min 150 min + 60 min/hr = 2.5 hr
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[1] The lowest SSC detected during SV Routine Events #1 and #2.

[2] 2,000 mg solid ÷ mg SSC / L = L to be sampled, rounded up to the nearest 25L.

[3] Pumping time is rounded up to nearest 0.5 hr and assumes maximum flow rate of 1.5 L/min is achieved and maintained for duration of sampling. Time does not include set-up or break-down of equipment on site, and does not include time for filter changes. Actual sampling duration per station will likely be higher.



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Matrix: Solids

Analytical Group: PCDD/PCDFs; Method 1613B; Analytical Perspectives, Wilmington, NC

Concentration Level: Low

Analyte	CAS Number	PAL (pg/sample) <sup>a</sup>	Project QL Goal (pg/sample)	Analytical Method <sup>b</sup>		Achievable Laboratory Limits <sup>c</sup>	
				MDLs (pg/g)	Method QLs (pg/g)	EDLs (pg/sample)	QLs (pg/sample)
Total Heptachlorodibenzofuran (HpCDF)	38998-75-3	NA	25	NA	NA	NA	25
Total Heptachlorodibenzo-p-dioxin (HpCDD)	37871-00-4	NA	25	NA	NA	NA	25
Total Hexachlorodibenzofuran (HxCDF)	55684-94-1	NA	25	NA	NA	NA	25
Total Hexachlorodibenzo-p-dioxin (HxCDD)	34465-46-8	NA	25	NA	NA	NA	25
Total Pentachlorodibenzofuran (PeCDF)	30402-15-4	NA	25	NA	NA	NA	25
Total Pentachlorodibenzo-p-dioxin (PeCDD)	36088-22-9	NA	25	NA	NA	NA	25
Total Tetrachlorodibenzofuran (TCDF)	55722-27-5	NA	10	NA	NA	NA	10
Total TCDD	41903-57-5	NA	10	NA	NA	NA	10
1,2,3,4,6,7,8-HpCDD	35822-46-9	25	25	NA	50	3.4	25
1,2,3,4,6,7,8-HpCDF	67562-39-4	25	25	NA	50	2.1	25
1,2,3,4,7,8-HxCDD	39227-28-6	25	25	NA	50	2.8	25
1,2,3,4,7,8-HxCDF	70648-26-9	25	25	NA	50	2.6	25
1,2,3,4,7,8,9-HpCDF	55673-89-7	25	25	NA	50	3.0	25
1,2,3,6,7,8-HxCDD	57653-85-7	25	25	NA	50	2.9	25
1,2,3,6,7,8-HxCDF	57117-44-9	25	25	NA	50	2.5	25
1,2,3,7,8,9-HxCDD	19408-74-3	25	25	NA	50	3.2	25
1,2,3,7,8,9-HxCDF	72918-21-9	25	25	NA	50	3.1	25
1,2,3,7,8-PeCDD	40321-76-4	25	25	NA	50	2.2	25
1,2,3,7,8-PeCDF	57117-41-6	25	25	NA	50	1.9	25

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2,3,4,6,7,8-HxCDF	60851-34-5	25	25	NA	50	2.6	25
2,3,4,7,8-PeCDF	57117-31-4	25	25	NA	50	1.8	25
2,3,7,8-TCDD	1746-01-6	10	10	NA	10	1.5	10
2,3,7,8-TCDF	51207-31-9	10	10	NA	10	1.2	10
OCDD	3268-87-9	50	50	NA	100	4.1	50
OCDF	39001-02-0	50	50	NA	100	3.4	50

- <sup>a</sup> PALs based on laboratory QLs derived from the low point of calibration. Note PALs are not risk based for this program.
- <sup>b</sup> Analytical MDLs and QLs are those documented in validated methods, modified for a 1 g sample size. "NA" indicates that MDL and/or QL values were not included in the validated methods.
- <sup>c</sup> Achievable EDLs (based on annual laboratory averaged EDLs including both field and lab QC samples) and QLs are limits that an individual laboratory can achieve when performing a specific analytical method. Actual EDLs and QLs will vary based on sample-specific factors. All results between the EDL and QL will be reported as estimated values (J qualifier). Laboratory results will be reported in pg/sample, rather than pg/g. These limits are applicable to both the particulate solids and PUF fraction which is treated as a solid during extraction and analysis. The final EDD will contain both the laboratory reported values (pg/sample) and values converted to pg/L for dissolved phase and pg/g for separated solids. The laboratory RL (i.e., the numerical value associated with a non-detect) will be based on the sample-specific EDL. Matrix interference can increase EDLs by as much as a factor of 10x, but common laboratory contaminants are not expected to significantly impact the laboratory sensitivity goals.

The volume of water to be sampled is dependent on the mass of suspended sediment at each station, as measured during Routine Event #1 and Routine Event #2 of the SV CWCM program. The volume of water sampled is calculated assuming 1g of solids may be separated assuming the lower end of the SSC from the SV CWCM data, with a buffer of 1g (2g solids total to be removed), rounded up to the nearest 25 L. Refer to Worksheet #37 for details on the data usability assessment with regard to sensitivity and calculations using SSC data and flow volume.

Estimated example volumes are provided below. These estimated volume sampled will be modified based on all data available from the preceding SV CWCM sampling events. The field records will include the proposed sampling volume per the HV CWCM QAPP, modified proposed sampling volume (including assumptions and calculations, if required), and the actual sample volume collected.

Location	SSC <sup>[1]</sup> (mg/L)	Date SSC Measured	Volume to achieve 2g solid at known SSC <sup>[2]</sup>	Pumping Time <sup>[3]</sup>
Above Dundee Dam	2.5	2/20/2012	2,000 mg solid ÷ 2.5 mg SSC / L = 800 L Proposed estimated sampling volume = 800 L	800L ÷ 1.5 L/min = 533 min 533 min ÷ 60 min/hr = 9 hr
RM 10.2	3.1	2/20/2012	2,000 mg solid ÷ 3.1 mg SSC / L = 645 L	650L ÷ 1.5 L/min = 433 min

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## QAPP Worksheet #15 (UFP-QAPP Manual Section 2.8.1) Data Quality Levels Reference Limits and Analytical Method Evaluation Table

			Proposed estimated sampling volume = 650 L	433 min ÷ 60 min/hr = 7.5 hr
RM 4.2 (Tidal 2)	11.9	2/21/2012	2,000 mg solid ÷ 11.9 mg SSC / L = 168 L Proposed estimated sampling volume = 175 L	175L ÷ 1.5 L/min = 117 min 117 min ÷ 60 min/hr = 2 hr
Kill van Kull	5.1	8/17/2011	2,000 mg solid ÷ 5.1 mg SSC / L = 392 L Proposed estimated sampling volume = 400 L	400L ÷ 1.5 L/min = 267 min 267 min ÷ 60 min/hr = 4.5 hr
NB South	4.9	8/18/2011	2,000 mg solid ÷ 4.9 mg SSC / L = 408 L Proposed estimated sampling volume = 425 L	425L ÷ 1.5 L/min = 283 min 283 ÷ 60 min/hr = 5 hr
NB Northeast	8.9	2/22/2012	2,000 mg solid ÷ 8.9 mg SSC / L = 224 L Proposed estimated sampling volume = 225 L	225L ÷ 1.5 L/min = 150 min 150 min ÷ 60 min/hr = 2.5 hr

[1] The lowest SSC detected during SV Routine Events #1 and #2.

[2] 2,000 mg solid ÷ mg SSC / L = L to be sampled, rounded up to the nearest 25 L.

[3] Pumping time is rounded up to nearest 0.5 hr and assumes maximum flow rate of 1.5 L/min is achieved and maintained for duration of sampling. Time does not include set-up or break-down of equipment on site, and does not include time for filter changes. Actual sampling duration per station will likely be higher.



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### QAPP Worksheet #15 (UFP-QAPP Manual Section 2.8.1) Data Quality Levels Reference Limits and Analytical Method Evaluation Table

Matrix: Water

Analytical Group: General Chemistry (see methods below), CAS, Kelso, WA

Concentration Level: Low

Analyte	CAS Number	Laboratory SOP <sup>a</sup>	PAL <sup>b</sup>	Units	Project QL (ug/L)	Analytical Method <sup>c</sup>		Achievable Laboratory Limits <sup>d</sup>	
						MDLs	Method QLs	MDLs	QLs
DOC	NA	C-13, C-16B	300	Micrograms per liter (ug/L)	300	NA	NA	100	300
POC	NA	C-16B	1300	Milligrams per liter (mg/L)	1300	NA	NA	500	1300
SSC	NA	C-17	1.0	mg/L	NA	NA	NA	1.0	1.0

<sup>a</sup> Refer to Worksheet #23 for laboratory SOPs.

<sup>b</sup> PALs are equivalent to the Project QLs.

<sup>c</sup> Analytical MDLs and QLs are those documented in validated methods.

<sup>d</sup> Achievable MDLs and QLs are limits that the selected laboratory can achieve when performing the specified methods (Worksheet #23) with nominal sample volumes in the absence of interferences. Actual MDLs and QLs will vary based on sample specific factors. All results between the MDL and QL will be reported as estimated values (J qualifier). The RL (i.e., the numerical value associated with a non-detect) will be the QL.

Activities	Organization	Dates (MM/DD/YY)		Deliverable	Deliverable Due Date
		Anticipated Date(s) of Initiation	Anticipated Date of Completion		
Project Status	de maximis, inc. / AECOM	Monthly	Monthly	Progress report	15 <sup>th</sup> of each month
Planning and Development of Study Objectives	de maximis, inc. / AECOM	June 2011	May 2012	QAPP	May 2012
Collection of Samples and Submission for Analysis	AECOM	November 2012	November 2012	Sample submission to laboratories	At time of collection
Laboratory Analysis	AECOM/CAS/ Analytical Perspectives	November 2012	January 2013	Analytical data to CPG	Beginning at 30 days after collection. See Worksheet #30 for turnaround times.
Data Validation and Verification	AECOM/ LDC	January 2013	March 2013	Validated data with progress report	15 <sup>th</sup> of each month
Preparation and Delivery of Data Report to USEPA	de maximis, inc. / AECOM	February 2013	May 2013	Draft HV Data Report	May 2013

**Describe and provide a rationale for choosing the sampling approach (e.g., grid system, biased statistical approach):**

The proposed sampling locations are presented in Figure 1 for this work. Sampling locations were chosen to provide:

- (1) Data collected from locations representing a variety of salinity levels, including freshwater and saline in the LPRSA, and lower to higher end salinity in NBSA;
- (2) Information regarding the chemical concentrations at the model domain boundaries and at inputs to the LPRSA, such as the NBSA and above Dundee Dam, to determine potential upgradient sources to the LPRSA;
- (3) Chemical concentration data from locations where SV chemical concentration data have been collected during the SV CWCM program; and,
- (4) Chemical concentration data from locations to be consistent with the physical parameters such as solids and organic carbon data have been collected during the SV CWCM and PWCM programs. Sampling for HV at locations sampled previously during the PWCM and SV CWCM programs will provide additional information on the temporal average concentrations of modifying parameters such as organic carbon, salinity, and solids concentrations.

**Describe the sampling design and rationale in terms of what matrices will be sampled, what analytical groups will be analyzed and at what concentration levels, the sampling locations (including QC, critical, and background samples), the number of samples to be taken, and the sampling frequency (including seasonal considerations):**

The sampling design incorporates the full extent of the LPRSA (RM 0 to 17.4), above Dundee Dam, and the NBSA. The proposed HV CWCM project includes one sampling event. The sampling will occur during normal flow conditions (400 – 3,000 cfs at Dundee Dam); the same flow regime established for the Routine Events in the SV CWCM QAPP.

The HV Sampling Event is proposed to occur during the summer of 2012. The sample locations will include the LPRSA, above Dundee Dam, and the NBSA (Worksheet #18). The data collected during the HV Event will support the development of partition coefficients for the selected analytes, provide data on the inputs to the LPRSA and NBSA from the boundaries, and provide information on the relative concentrations of solids-bound and dissolved phase analytes.

Thirty-six (36) samples will be collected during the HV Event to be analyzed for target analytes as defined in Worksheet #15. The samples are twenty-four whole water time-weighted composite sub-samples for POC, DOC and SSC (four sub-samples at each station); six separated solids samples for PCBs and PCDD/Fs; and six sorption medium samples for PCBs and PCDD/Fs. Samples will be collected from one depth at each location (see Worksheet #18). QC samples will be collected at the frequency provided in Worksheet #20.

During the sampling, continuous monitoring of dissolved oxygen, pH, specific conductivity, temperature and salinity will be recorded using a multi-parameter water quality meter per SOP LPR-FI-05 (Appendix A). Particle size and estimated concentration will be monitored continuously using a LISST deployed at sample depth. Flow rates through the HV sampling system will also be regularly monitored and recorded and adjusted as necessary per SOP SW-19 (Appendix A).

Details of the sampling methods are presented in Appendix A (Field Sampling SOPs) and Worksheets #14 and #21.



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***QAPP Worksheet #17 (UFP-QAPP Manual Section 3.1.1) Sampling Design and Rationale***

Sampling Location <sup>a</sup>	Matrix	Depth Intervals	Analyses	Number of Samples per Medium <sup>b</sup>	Sampling SOP Reference	Rationale for Sampling Location
Above Dundee Dam	<ul style="list-style-type: none"> <li>Water</li> <li>Separated solids</li> <li>Sorption medium</li> </ul>	One depth – mid-depth	Water: <ul style="list-style-type: none"> <li>• POC</li> <li>• DOC</li> <li>• SSC</li> </ul> Solid Matrices: <ul style="list-style-type: none"> <li>• PCDD/Fs</li> <li>• PCB congeners and homologs</li> </ul>	Four water sub-samples Three solid matrices: <ul style="list-style-type: none"> <li>• One Separated solids</li> <li>• Two Sorption medium</li> </ul>	LPR-FI-04 LPR-FI-05 SW-19	Upstream boundary condition for the LPRSA. Potential estimation of contaminant fluxes to the LPRSA from upstream.
RM 10.2	<ul style="list-style-type: none"> <li>Water</li> <li>Separated solids</li> <li>Sorption medium</li> </ul>	One depth – three feet from bottom	Water: <ul style="list-style-type: none"> <li>• POC</li> <li>• DOC</li> <li>• SSC</li> </ul> Solid Matrices: <ul style="list-style-type: none"> <li>• PCDD/Fs</li> <li>• PCB congeners and homologs</li> </ul>	Four water sub-samples Three solid matrices: <ul style="list-style-type: none"> <li>• One Separated solids</li> <li>• Two Sorption medium</li> </ul>	LPR-FI-04 LPR-FI-05 SW-19	Data to support development of partition coefficients for the CFT model representing the LPR. This location represents freshwater section of the river.
RM 4.2 [Tidal 2 if flow is < 1,000 cfs at Dundee Dam <sup>c</sup> ]	<ul style="list-style-type: none"> <li>Water</li> <li>Separated solids</li> <li>Sorption medium</li> </ul>	One depth –three feet from bottom	Water: <ul style="list-style-type: none"> <li>• POC</li> <li>• DOC</li> <li>• SSC</li> </ul> Solid Matrices: <ul style="list-style-type: none"> <li>• PCDD/Fs</li> <li>• PCB congeners and homologs</li> </ul>	Four water sub-samples Three solid matrices: <ul style="list-style-type: none"> <li>• One Separated solids</li> <li>• Two Sorption medium</li> </ul>	LPR-FI-04 LPR-FI-05 SW-19	Data to support development of partition coefficients for the CFT model representing the LPR. This location represents the higher end of salinity in the river. PCBs and PCDD/Fs were detected during SV Routine Events, indicating this is an area of higher water column constituent concentrations.

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**QAPP Worksheet #18 (UFP-QAPP Manual Section 3.1.1) Sampling Locations and Methods/SOP Requirements Table <sup>1,2</sup>**

NB Northeast - subtidal area on eastern shore north of Branch Channel and west of NB North	<ul style="list-style-type: none"> <li>Water</li> <li>Separated solids</li> <li>Sorption medium</li> </ul>	One depth – three feet from bottom	Water: <ul style="list-style-type: none"> <li>POC</li> <li>DOC</li> <li>SSC</li> </ul> Solid Matrices: <ul style="list-style-type: none"> <li>PCDD/Fs</li> <li>PCB congeners and homologs</li> </ul>	Four water sub-samples Three solid matrices: <ul style="list-style-type: none"> <li>One Separated solids</li> <li>Two Sorption medium</li> </ul>	LPR-FI-04 LPR-FI-05 SW-19	Data to support development of partition coefficients for the CFT model representing NB. This location represents the lower end of salinity in NB, and is in a shallow, sub-tidal flat.
NB South – eastern side of shipping channel off southern edge of Elizabeth Port Authority Marine Terminal	<ul style="list-style-type: none"> <li>Water</li> <li>Separated solids</li> <li>Sorption medium</li> </ul>	One depth – three feet from bottom	Water: <ul style="list-style-type: none"> <li>POC</li> <li>DOC</li> <li>SSC</li> </ul> Solid Matrices: <ul style="list-style-type: none"> <li>PCDD/Fs</li> <li>PCB congeners and homologs</li> </ul>	Four water sub-samples Three solid matrices: <ul style="list-style-type: none"> <li>One Separated solids</li> <li>Two Sorption medium</li> </ul>	LPR-FI-04 LPR-FI-05 SW-19	Data to support development of partition coefficients for the CFT model representing NB. This location represents the higher end of salinity in NB, and is in the deeper part of the bay. NB South represents the southern boundary of the NBSA.
Kill van Kull near eastern edge of Mayor Dennis P. Collins Park	<ul style="list-style-type: none"> <li>Water</li> <li>Separated solids</li> <li>Sorption medium</li> </ul>	One depth – three feet from bottom	Water: <ul style="list-style-type: none"> <li>POC</li> <li>DOC</li> <li>SSC</li> </ul> Solid Matrices: <ul style="list-style-type: none"> <li>PCDD/Fs</li> <li>PCB congeners and homologs</li> </ul>	Four water sub-samples Three solid matrices: <ul style="list-style-type: none"> <li>One Separated solids</li> <li>Two Sorption medium</li> </ul>	LPR-FI-04 LPR-FI-05 SW-19	Boundary condition for the NBSA. Potential estimation of contaminant fluxes to NB from the NY Harbor system.

**Notes:**

<sup>a</sup> Specific locations can be found in Figure 1.

<sup>b</sup> The number of sorption medium samples will be two for the first round of HV sampling. Need for a secondary PUF cartridge will be evaluated following



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### ***QAPP Worksheet #18 (UFP-QAPP Manual Section 3.1.1) Sampling Locations and Methods/SOP Requirements Table <sup>1,2</sup>***

completion of the first round of sampling. See Worksheet #11.

- <sup>c</sup> The location of Tidal 2 (applicable when flows are < 1,000 cfs) is based on the location of the salt wedge and the location of Tidal 1 per the SV CWCM QAPP (AECOM, 2011a). Tidal 2 will be located halfway between Tidal 1 and RM 1.4, but not upstream of RM 4.2. See Exhibit 1 and Exhibit 1 of the FSP Addendum (Appendix A) to the SV CWCM QAPP (AECOM, 2011a).

Matrix	Analytical Group	Concentration Level	Analytical and Preparation Method/SOP Reference <sup>a</sup>	Sample Size <sup>b</sup>	Containers (number, size, and type)	Preservation Requirements	Maximum Holding Time <sup>c</sup> (preparation/analysis)
Solid (Separated Solids)	PCBs (Homologs and Congeners)	Low	AP-3	Entire Contents of Vortex Cup, Flat Filter and, Glass Wool (containerized separately in the self-contained stainless steel cartridge and added to other solids at laboratory)	8 ounce (oz) wide mouth glass (amber preferred)	During shipment: 0-6°C; store in the dark; upon arrival at lab: store at <-10°C in the dark	365 calendar days for preparation and analysis
Solid (Sorption Media [PUF])	PCBs (Homologs and Congeners)	Low	AP-3	Entire PUF Sorbents – Primary and Secondary	PR2900 Sorbent Cartridge	During shipment: 0-6°C; store in the dark; upon arrival at lab: store at 0-6°C in the dark	365 calendar days for preparation and analysis
Solid (Separated Solids)	PCDD/Fs	Low	AP-1	Entire Contents of Vortex Cup, Flat Filter, and Glass Wool (containerized separately in the self-contained stainless steel cartridge and added to other solids at laboratory)	8 oz wide mouth glass (amber preferred)	During shipment: 0-6°C; store in the dark; upon arrival at lab: store at <-10°C in the dark	365 calendar days for preparation and analysis



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### QAPP Worksheet #19 (UFP-QAPP Manual Section 3.1.1) Analytical SOP Requirements Table

Solid (Sorption Media [PUF])	PCDD/Fs	Low	AP-1	Entire PUF Sorbents – Primary and Secondary	PR2900 Sorbent Cartridge	During shipment: 0-6°C; store in the dark; upon arrival at lab: store at 0-6°C in the dark	365 calendar days for preparation and analysis
Water	POC/DOC	Low	C-13, C-16B	500 milliliter (mL)	2 x 250mL plastic	0-6°C	Ship to the laboratory and filter using a 0.7um glass fiber filter within 48 hours. Filters and filtrates must be analyzed within 28 days
Water	SSC	Low	C-17	2 L	2 tared 1-L plastic	4±2°C; store in the dark; weigh entire sample bottle to nearest 0.1 g and record weight upon receipt at laboratory	28 days to analysis

<sup>a</sup> Refer to Worksheet #23 for SOP titles.

<sup>b</sup> Sample size is the minimum requested by each laboratory to perform the requested analysis; minimum sample size requirements reflect the additional sample needed to permit the laboratory to achieve the project QLs. Additional sample volume is need for field QC samples (e.g., MSs).

<sup>c</sup> Begins at time of collection.

Matrix	Analytical Group	Conc. Level	Analytical and Preparation SOP Reference <sup>a</sup>	No. of Sampling Locations (No. of Samples)	No. of Field Duplicates <sup>b</sup>	No. of Rinsate Blanks <sup>c</sup>	No. of PE Samples <sup>d</sup>	Total No. of Samples to Lab
Solid (Separated Solids)	PCBs (Homologs and Congeners)	Low	AP-3	6 (6)	1	2	1	10
Solid (Sorption Media [PUF])	PCBs (Homologs and Congeners)	Low	AP-3	6 (12) <sup>e</sup>	1	2	0	15
Solid (Separated Solids)	PCDD/Fs	Low	AP-1	6 (6)	1	2	1	10
Solid (Sorption Media [PUF])	PCDD/Fs	Low	AP-1	6 (12) <sup>e</sup>	1	2	0	15
Water	POC	Low	C-16B	6 (24) <sup>f</sup>	2	2	0	28
Water	DOC	Low	C-13, C-16B	6 (24) <sup>f</sup>	2	2	0	28
Water	SSC	Low	C-17	6 (24) <sup>f</sup>	2	2	0	28

<sup>a</sup> Refer to Worksheet #23 for SOP title

<sup>b</sup> Field duplicates will be collected at a frequency of 1 per 20 samples unless noted otherwise. Separated solids and sorption media (PUF) field duplicate samples will be collected (as co-located samples) using a second PR2900 HV sampler at a sample location simultaneously. For the SSC and POC/DOC samples, a second set of subsamples (field duplicates) will be collected from the 20 L carboy, with the parent and field duplicate samples being collected in an alternating fashion (i.e., SSC sample collected, SSC field duplicate collected; POC/DOC sample collected, POC/DOC field duplicate collected). The parent samples and the field duplicates will be submitted to the laboratory, analyzed, and reported as separate samples.

<sup>c</sup> Equipment rinsate blanks will be collected at a frequency of one per sampling team for each set of decontaminated equipment utilized (e.g., PR2900, 20 L carboy, tubing, etc.). One equipment rinsate blank per task was assumed, based on a one week field program and two field teams. The equipment blank will be collected mid-program, between sampling locations, after equipment has been decontaminated, using 100 L of deionized water per blank sample. Details of the blank collection are provided in SOP SW-19.

<sup>d</sup> If the HV CWCM program occurs within six months of the Low Resolution Coring Supplemental Sampling Program (LRC SSP) and RM 10.9 supplemental programs and the same laboratories will be used for the LRC SSP and RM 10.9 supplemental program analyses, a pre-program PE study will not be performed prior to the HV CWCM program. However, known PE samples obtained from a commercial vendor (e.g., Resource Technology Corporation [RTC] or Wibby Environmental), which are not blind, will be inserted with sample shipments at a rate of 1 per 20 samples for PCDD/Fs and PCBs (homologs and congeners). A pre-program PE study will be conducted if there is a change in laboratories.

<sup>e</sup> For the first round of HV sampling, two PUF cartridges will be used in series. The two PUF cartridges will be used to represent the sum total of mass of HOCs in the dissolved phase, and the results, reported separately by the laboratory, will be summed for the EDD per Worksheet #37. The need for the second PUF cartridge will be reviewed following analysis of the first round of data.

<sup>f</sup> Four sub-samples will be collected from each location for POC, DOC and SSC. These sub-samples will be used to better estimate actual concentrations in the water column, and are not QC samples. Data use for the sub-samples is provided in Worksheet #37. The average concentration of the four sub-samples will be reported in the EDDs and used in calculations presented in Worksheet #37. Field duplicates will also be collected for measuring precision.

The following is a list of all SOPs associated with project sampling including, but not limited to, sample collection, sample preservation, equipment cleaning and decontamination, equipment testing, inspection and maintenance, supply inspection and acceptance, and sample handling and custody.

Reference Number	Title, Revision Date and/or Number	Originating Organization	Equipment Type	Modified for Project Work? (Y/N)	Comments
LPR-FI-04	Small Volume Surface Water Sampling/Chemical Data Collection	AECOM	Various – see Appendix A	Yes <sup>a</sup>	Appendix A
LPR-FI-05	Water Column Profiling	AECOM	Various – see Appendix A	Yes <sup>b</sup>	Appendix A
LPR-FI-06	Surface Water Sampling for Trace Metals	AECOM	Various – see Appendix A	Yes <sup>c</sup>	Appendix A
LPR-G-01	Field Records	AECOM	NA	No	Appendix A
LPR-G-02	Navigation/Positioning	AECOM	Differential Global Positioning System (dGPS)	No	Appendix A
LPR-G-03	Equipment Decontamination	AECOM	Various – see Appendix A	No	Appendix A
LPR-G-04	Investigative Derived Waste (IDW) Handling and Disposal	AECOM	Various – see Appendix A	No	Appendix A
LPR-G-05	Sample Custody	AECOM	NA	No	Appendix A
LPR-G-06	Sample Packaging and Shipping	AECOM	NA	No	Appendix A
SW-19	High-Volume Surface Water Sampling for Analysis of Organic Compounds with Low Detection Limits – Lower Passaic River Restoration Project	Gravity	PR2900	No	Appendix A

Procedural modifications to these documents may be warranted depending upon field conditions, equipment limitations, or limitations imposed by the procedure. Substantive modification will be approved in advance by the AECOM Project QA Manager and CWCM Task Manager and communicated to the CPG Coordinator and to the USEPA RPM. Deviations will be documented in the field records.

<sup>a</sup> SOP LPR-FI-04 will be modified for project work. For the collection of SSC, POC and DOC, water will be subsampled, per the SOP from a 20 L carboy. The carboy will be filled concurrent with the sampling of water in the PR2900 using a second, dedicated peristaltic pump and tubing consistent with LPR-FI-04, but at a slower rate, such that filling the carboy to approximately 15L is completed as the HV sampling is completed, but 20 L is not exceeded.

- 1) The carboy will be filled using a peristaltic pump with dedicated tubing, as per SOP LPR-FI-04.
- 2) Flow rates will be estimated by dividing 15 L (target fill volume of water in 20 L carboy) by the volume of water to be sampled using the PR2900 (e.g., 450L) and multiplying the result by 1.5 L (the maximum desired flow rate of the PR2900). In this example, the flow rate would be 3.3% of 1.5L/min, or 0.05 L/min. Flow rates will be calibrated at the beginning of sampling and will be monitored in the carboy every 15 minutes using a graduated cylinder and stop watch.
- 3) As the carboy is filled, the water will be continuously homogenized using a three inch decontaminated Teflon coated magnetic stir bar on a stir plate.
- 4) Upon completion of the pumping, the carboy will be subsampled by cutting the end of the intake tubing to an appropriate length, and

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### ***QAPP Worksheet #21 (UFP-QAPP Manual Section 3.1.2) Project Sampling SOP References Table***

reversing the flow in the peristaltic pump. Care will be taken to ensure the intake tube is located centrally in the carboy and does not lie against the sides. Bottles will be filled for POC, DOC and SSC per SOP LPR-FI-04. Sub-samples will be collected sequentially. Field duplicates will be collected from a duplicate carboy set up with the co-located PR2900 used to collect the PCDD/F and PCB field duplicates.

- <sup>b</sup> SOP LPR-FI-05 will be modified for project work. A LISST will be used to monitor the concentrations of suspended sediments and neutrally buoyant algae-like particles. These data will be used to monitor the need for filter changes. The LISST will be deployed at sample depth with the YSI sonde. If necessary, a flow-through chamber may be used.

  - 1) The flow through chamber on the LISST, if used, will be decontaminated using Liquinox solution, DI water and methanol per SOP LPR-G-03.
  - 2) The LISST is connected near the YSI sonde at sample depth using cable ties. If a flow-through chamber is used, the LISST is placed in-line prior to the 20L carboy such that water flows through the LISST then into the 20L carboy.
  - 3) The LISST is connected to on-board computer, which will record all data. The data may be monitored live on the computer screen for fluctuations in solids size and concentration.
- <sup>c</sup> SOP LPR-FI-06 will be modified for project work. The SOP shall apply to equipment used to collect low-level PCDD/Fs and PCBs as well as trace metals.

Field Equipment	Calibration Activity	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference <sup>1</sup>
YSI	Temperature sensors are factory calibrated. Conductivity, pH, salinity are calibrated against fixed calibration solutions. Dissolved oxygen calibrated in air.	Battery checks performed every morning before use, and charged every evening after use. All probes will be kept clean of debris and membranes free of tears.	Calibrate per manufacturer's specifications (Section 2.6 of manual, provided with equipment).	Daily for functionality	Daily or recalibrate as needed	Dissolved Oxygen goal is $\pm 0.5$ mg/L of saturation in air.  pH goal is $\pm 0.3$ with buffer solutions.  Conductivity goal is $\pm 10\%$ of standard.  Salinity goal is $\pm 10\%$ of standard.	Recalibrated or replaced	AECOM FTM or designee	LPR-FI-05
PR2900	Factory calibrated	Clean daily and in between samples	Check flow rates using graduated cylinder and stop watch	Daily for functionality	Daily	Within 10% of measured flow	Replace instrument	Gravity field personnel	SW-19
LISST	Factory calibrated	Battery checks performed every morning before use, and charged every evening after use	Perform blank measurement using clean, particle-free water	Daily for functionality	Daily and as close to possible to the deployment time	Within a factor of 2 to 4 of the factory background	Replace instrument	Gravity field personnel	LPR-FI-05

<sup>1</sup> Refer to the Project Sampling SOP References table (Worksheet #21).

Reference Number <sup>a,b,c</sup>	Primary Method Reference <sup>b</sup>	Laboratory SOP Title, Revision Date, and/or Number	Definitive or Screening Data	Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work? (Y/N)
AP-3	EPA 1668A <sup>d</sup>	High Resolution Mass Spectrometry Method 1668A for Solid/Air/Aqueous/Tissue Matrices, AP-CM-7, Rev. 9-1, 10/8/2010, modified as appropriate per the SOP addendum for High Volume Sampling, 5/22/12	Definitive	Organics (PCB Congeners)	High Resolution Gas Chromatograph/ High resolution Mass Spectrometer (HRGC/HRMS)	Analytical Perspectives, Wilmington, NC	Toluene Soxhlet /Dean Stark (SDS) extraction option is specified; Static spikes and Dynamic spikes added for sorption media samples. Solid phase sample will consist of one jar containing vortex separatory water, separated solids, and 0.7 um filters; glass wool and captured solids will be included when removed from cartridge at the laboratory. The laboratory will add hydromatrix manufactured by Agilent Technologies, Inc. The PCDD/F and PCB fractions will be separated during cleanups. See SOP addenda for complete details.



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### QAPP Worksheet #23 (UFP-QAPP Manual Section 3.2.1) Analytical SOP References Table<sup>a</sup>

AP-1	EPA 1613B <sup>e</sup>	Polychlorinated Dibenzo Dioxin/Furans, AP-CM-5, Rev. 15, 10/8/2010, modified as appropriate per the SOP addendum for High Volume Sampling, 5/22/12	Definitive	Organics (PCDD/Fs)	HRGC/HRMS	Analytical Perspectives, Wilmington, NC	Toluene/SDS extraction option specified; Static spikes and Dynamic spikes added for sorption media samples. Solid phase sample will consist of one jar containing vortex separatory water, separated solids, and 0.7 um filters; the glass wool and captured solids will be included when removed from cartridge at the laboratory. The laboratory will add hydromatrix manufactured by Agilent Technologies, Inc. The PCDD/F and PCB fractions will be separated during cleanups. See SOP addenda for complete details.
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**QAPP Worksheet #23 (UFP-QAPP Manual Section 3.2.1) Analytical SOP References Table<sup>a</sup>**

C-16	EPA 440 <sup>f</sup>	Sample Preparation for Particulate Carbon and Nitrogen and Particulate Organic Carbon in Water GEN-PC PN POC PREP, Rev. 01, 7/27/2012	Definitive	General Chemistry	Total Organic Carbon (TOC) Analyzer	CAS-Tucson, AZ	N, note the nominal pore size of the GF/F filter used must be 0.7 um. POC and DOC will be performed on sample from the same container
C-16B	EPA 440 <sup>f</sup>	Total Carbon and Sulfur by Combustion / Infrared Detection, CHM-CS500, Rev.1, 7/27/2012	Definitive	General Chemistry	Total Organic Carbon (TOC) Analyzer	CAS-Tucson, AZ	No
C-13	Standard Methods (SM) 5310C <sup>g</sup>	Total Organic Carbon in Water, GEN-TOC, Rev. 11, 2/19/2010	Definitive	General Chemistry	TOC Analyzer (Persulfate Oxidation Method)	CAS-Kelso, WA	N, note DOC and POC will be performed on samples from the same container
C-17	American Society for Testing and Materials (ASTM) D 3977 <sup>h</sup>	Standard Test Methods for Determining Sediment Concentration in Water Samples, GEN-D3977, Rev. 0, 7/11/2011	Definitive	General Chemistry	Analytical Balance	CAS-Kelso, WA	N, Note Test Option B without the 14 day settling time will be used. The nominal pore size of the GF/F filter used must be 0.7 um.

<sup>a</sup> All SOPs are contained in Appendix B.

<sup>b</sup> It is expected that the procedures outlined in these SOPs will be followed. Procedural modifications to individual SOPs may be warranted depending upon an individual sample matrix, interferences encountered, or limitations imposed by the procedure. Deviations from individual SOPs will be documented in the laboratory records. Substantive modification to any SOP will be approved in advance by the AECOM Project QA Manager and AECOM Task Manager and communicated to the CPG Coordinator and to the USEPA RPM. The ultimate procedure employed will be documented in the report summarizing the results of the sampling event or field activity.

<sup>c</sup> The reference numbers presented in this worksheet use a numbering system that is consistent between the current sediment characterization programs (i.e., RM 10.9, LRC SSP). However, only the reference numbers and associated SOPs for the HV CWCM are presented in this Worksheet #23.

<sup>d</sup> USEPA 2003



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### ***QAPP Worksheet #23 (UFP-QAPP Manual Section 3.2.1) Analytical SOP References Table<sup>a</sup>***

- <sup>e</sup> USEPA 1994
- <sup>f</sup> USEPA 1997
- <sup>g</sup> American Public Health Association (APHA) 1998
- <sup>h</sup> ASTM 2010

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	CA	Person Responsible for CA	SOP Reference <sup>a</sup>
HRGC/HRMS (PCB Congeners)	Retention time calibration, initial calibration, continuing calibration as required in SOP	Initial calibration after instrument set up, after major instrument changes and when continuing calibration criteria are not met. Calibration verification minimum every 12 hours	ICAL percent relative standard deviation (%RSD) < 20% for target analytes calculated by isotope dilution. %RSD < 35% for target analytes calculated by internal standard. Continuing calibration verification (CCV) < 30% Drift for Toxics and Level of Chlorination (LOC) congeners CCV 40-160% for non-Toxic congeners	Inspect system, correct problem, rerun calibration and affected samples	Analyst	AP-3
HRGC/HRMS (PCDD/Fs)	Perfluorokerosene (PFK) Tune; initial and continuing calibration as required in SOP	Initial calibration after instrument set up, after major instrument changes and when continuing calibration criteria are not met. Continuing calibration minimum every 12 hours	%RSD for mean response of unlabeled standards ≤ 20%; labeled reference compounds ± 35%; Continuing calibration per SOP Table 6	Inspect system, correct problem, rerun calibration and affected samples	Analyst	AP-1
TOC Analyzer (DOC, POC)	Initial and continuing calibration per SOP	CCV each batch	ICAL linearity $r^2 \geq 0.995$ Initial Calibration Verification (ICV) +/- 10% true value CCV +/- 10% true value.	Inspect system, correct problem, rerun calibration and affected samples	Analyst	C-13, C-16B
Analytical Balance (SSC)	Daily	Weigh and record National Institute of Standards and Technology (NIST) traceable standard weight in range of interest	± 5% of certified weight	Inspect system, correct problem, rerun calibration and affected samples	Analyst	C-17

<sup>a</sup>Refer to the Analytical SOP References table (Worksheet #23). All SOPs are contained in Appendix B.

Instrument/ Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	CA	Responsible Person	SOP Reference <sup>a</sup>
HRGC/HRMS (PCB Congeners)	Clean sources; maintain vacuum pumps	Tuning	Instrument performance and sensitivity	Service vacuum pumps once per year; other maintenance as needed	See SOP	See SOP	Analyst or Section Supervisor	AP-3
HRGC/HRMS (PCDD/Fs)	Clean sources and quadrupole rods; maintain vacuum pumps	Tuning	Instrument performance and sensitivity	Service vacuum pumps twice per year; other maintenance as needed	See SOP	See SOP	Analyst or Section Supervisor	AP-1
TOC Analyzer (DOC, POC)	Replace disposables, clean quartz boat; oven thermometer calibration quarterly	Analytical standards	Check connections	Daily or as needed	See SOP	See SOP	Analyst or Section Supervisor	C-13, C- 16B
Analytical Balance (SSC)	Clean balance after each use; service annually	NIST Traceable weights	Check for cleanliness	Prior to every use	Measured weight within certified tolerance	Clean, verify zero on balance, reweigh; call for service	Analyst or Section Supervisor	C-17

<sup>a</sup> Refer to the Analytical SOP References table (Worksheet #23). All SOPs are contained in Appendix B.

<b>SAMPLE COLLECTION, PACKAGING, AND SHIPMENT</b>
Sample Collection (Personnel/Organization): AECOM Field Team (see Worksheet #21 for a list of the sample collection methods)
Sample Packaging (Personnel/Organization): AECOM Field Team
Coordination of Shipment (Personnel/Organization): AECOM Field Team
Type of Shipment/Carrier: UPS or FedEx for overnight delivery or laboratory courier
<b>SAMPLE RECEIPT AND ANALYSIS</b>
Sample Receipt (Personnel/Organization): Assigned laboratory personnel (see Worksheet #30 for laboratories providing analytical services)
Sample Custody and Storage (Personnel/Organization): Assigned laboratory personnel (see Worksheet #30 for laboratories providing analytical services)
Sample Preparation (Personnel/Organization): Assigned laboratory personnel (see Worksheet #30 for laboratories providing analytical services)
Sample Determinative Analysis (Personnel/Organization): Assigned laboratory personnel (see Worksheet #30 for laboratories providing analytical services)
<b>SAMPLE ARCHIVING</b>
Field Sample Storage (No. of days from sample collection): Samples will not be stored in the field but will be shipped to the designated laboratory the same day as collection or no later than the day after collection. If circumstances require that the samples be stored in the field, they will be maintained under the method-specified conditions (e.g., kept at $4 \pm 2^{\circ}$ C).
Sample Extract/Digestate Storage (No. of days from extraction/digestion): Sample extraction and digestion holding times are summarized in Worksheet #19.
<b>SAMPLE DISPOSAL</b>
Personnel/Organization: Assigned laboratory personnel (see Worksheet #30 for laboratories providing analytical services).
Number of Days from Analysis: Varies by laboratory; laboratory is required to give AECOM 30 days notice prior to intent to discard any project samples.

### Sample Handling and Custody

Sample custody procedures ensure the timely, correct, and complete analysis of each sample for all parameters requested. A sample is considered to be in someone's custody if it:

- Is in his/her possession
- Is in his/her view, after being in his/her possession
- Is in his/her possession and has been placed in a secured location



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### ***QAPP Worksheet #26 (UFP-QAPP Manual Appendix A) Sample Handling System***

- Is in a designated secure area

Sample custody documentation provides a written record of sample collection and analysis. The sample custody procedures require the specific identification of samples associated with an exact location and the recording of pertinent information associated with the sample, including time of collection and any preservation techniques, and a COC record which serves as physical evidence of sample custody. Custody procedures will be similar to the procedures outlined in USACE's *Requirements for the Preparation of Sampling and Analysis Plans* (USACE 2001) and the USEPA's *Contract Laboratory Program Guidance for Field Samplers* (USEPA 2007b). The COC documentation system provides the means to individually identify, track, and monitor each sample from the time of collection through final data reporting. Sample custody procedures are developed for three areas: sample collection, laboratory analysis, and final evidence files, which are described in Worksheet #27 and SOP LPR-G-05.

### **Field Sample Handling and Custody**

Field records provide a means of recording information for each field activity performed at the site. COC procedures document pertinent sampling data and all transfers of custody until the samples reach the analytical laboratory. The sample packaging and shipment procedures summarized in Worksheet #27 are designed to ensure that the samples arrive at the laboratory with the COC intact. Specific preservation procedures required for each analytical method are described in Worksheet #19.

**Field Sample Custody Procedures (sample collection, packaging, shipment, and delivery to laboratory):** The field sample custody procedures including sample packing, shipment, and delivery requirements, are discussed in Worksheet #26. Sample management information is also provided in SOPs LPR-G-05 and LPR-G-06.

**Laboratory Sample Custody Procedures (receipt of samples, archiving, disposal):** Each laboratory has a sample custodian who accepts custody of the samples and verifies that the information on the sample labels matches the information on the COC. The sample custodian will document any discrepancies, document sample condition upon receipt at the laboratory and will sign and date all appropriate receiving documents. Additional information on laboratory sample receiving procedures is provided in the text below this summary table.

**Sample Identification Procedures:** Each sample will be assigned a unique sample identification number using the LPR Data Management System. This identification nomenclature will consist of an alphanumeric code that identifies the program, sample location (including depth interval if needed), and sample type. Details of sample identification are provided below.

**COC Procedures:** A COC will accompany all samples from the time of sampling through all custody transfers. Samples of the COC forms are provided in LPR-G-05; the COC procedures are summarized below and in SOP LPR-G-05 provided in Appendix A.

### Sample Identification

Samples will be uniquely identified at the time of collection. The sample identifiers will be assigned according to the following pattern:

[Program]-[Event]-[Station]-[DepthTypeSubsample]

Where:

Program	Two-digit year plus sequence letter to distinguish sampling programs. As an example: "12H" for the HV sampling event, assuming it is the eighth LPR sampling event of 2012.
Event	"CE" plus two-digit sequence number: Since the HV program is tide-independent and hydrographically-independent, the event will be CE05.
Station	"T" plus three-digit representation of RM by tenths" "T014" for station at RM 1.4
Depth	Single character sequence letter for depth interval, with "X" reserved to indicate no depth interval: "A" for first (uppermost) depth interval (i.e., 3 feet below surface or mid-water column), "B" for lower depth ( i.e., 3 feet from bottom), etc.
Type	Single character for sample type: "W" for normal sample of whole water, "P" for normal sample of particulates (separated solids), "M" for normal sample of sorption medium (e.g., PUF), "Y" for field duplicate of whole water, "Q" for field duplicate of separated solids, "N" for field duplicate of sorption medium, "R" for equipment rinsate blank
Subsample	Sequential single digit for sub-sample number, beginning with 1. If only one sample is collected, "1" will be used. For blanks (i.e., "XR" samples, "1" will indicate whole water, "2" will indicate particles, and "3" will indicate PUF).

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### ***QAPP Worksheet #27 (UFP-QAPP Manual Section 3.3.3) Sample Custody Requirements***

For example:

- A sample labeled 12H-CE05-T102-BP1 identifies a HV CWCM program (12H) sample collected at RM 10.2. The sample is from 3 feet from bottom (B) and is identified as a normal separated solids sample (P). No sub-samples were collected (1).
- A sample labeled 12H-CE05-T175-AN1 identifies a HV CWCM program (12H) sample collected above Dundee Dam. The sample is from the mid-depth interval (A) and is identified as a sorption medium field duplicate sample (N). No sub-samples were collected (1).
- A sample labeled 12H-CE05-TNBS-BY3 identifies a HV CWCM program (12H) sample collected at NB South. The sample is from 3 feet from bottom (B) and is identified as a whole water field duplicate sample (Y) collected with the third sub-sample from the carboy (3).
- A sample labeled 12H-CE05-T014-XR3 identifies a HV CWCM program (12H) sample collected in conjunction with sampling at RM 1.4. The sample is an equipment blank (XR) PUF sample (3). Note that although equipment rinsate blanks are assigned a sample number related to a sample recently processed or collected, this is for identification purposes only. Equipment rinsate blanks are collected periodically and are considered reflective of decontamination procedures for the period (refer to Worksheet #20). They are therefore applicable to all samples collected during that period of the survey using a particular type of equipment.

### **Chain of Custody Procedure**

The COC form serves as an official communication to the laboratory detailing the specific analyses required for each sample. The COC record is prepared by the field sample custodian and accompanies samples from the time of sampling through all transfers of custody. The COC will be retained by the laboratory which analyzes and archives the samples. Three copies of the COC are created; one copy is retained in the field and two copies are sent to the laboratory.

### **Transfer of Custody and Shipment**

Sample custody must be maintained from the time of sampling through shipment and receipt at the laboratory. The procedures for custody transfer are outlined in SOP LPR-G-05 (included in Appendix A).

### **Sample Packaging and Shipping Requirements**

Sample custody must be maintained through shipment of samples to the contracted laboratory. All samples will be packaged and shipped at the end of each day unless other arrangements have been made with the laboratory. Samples will be delivered directly to the laboratory by sampling personnel or will be shipped using the procedures outlined in SOP LPR-G-6 (Appendix A).

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### ***QAPP Worksheet #27 (UFP-QAPP Manual Section 3.3.3) Sample Custody Requirements***

#### **Laboratory Custody Procedures**

Each contracted laboratory will have a SOP that details the procedures used to document sample receipt and custody within the laboratory. The following procedures must be addressed in the laboratory custody SOP:

- Each laboratory must have a designated sample custodian who accepts custody of the samples at the time of delivery to the laboratory and verifies that the information on the sample labels matches the information on the COC. The sample custodian must sign and date all appropriate receiving documents and note any discrepancies in sample documentation as well as the condition of the samples at the time of receipt.
- Once the samples have been accepted by the laboratory, checked, and logged in, they must be maintained in accordance with laboratory custody and security requirements as outlined in the laboratory QMP.
- To ensure traceability of samples during the analytical process the laboratory will assign a sample identification (ID) number based on procedures outlined in the laboratory QMP or laboratory SOP.
- The following procedures, at a minimum, must be documented by the laboratory:
  - Sample extraction /preparation
  - Sample analysis
  - Data reduction
  - Data reporting
- Laboratory personnel are responsible for sample custody until the samples are returned to the sample custodian.
- When sample analysis and QC procedures are completed any remaining sample must be stored in accordance with contractual terms. A minimum of 30 days notice must be provided before disposal of any sample. Data sheets, custody documents and all other laboratory records must be retained in accordance with contractual agreements.

#### **Final Evidence Files**

Laboratory records including COCs and other sample receiving records, sample preparation and analysis records, and the final data package become part of the laboratory final evidence file and must be retained as required by the contractual agreement. A PDF copy of the data package and



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associated electronic deliverable must be provided to AECOM in accordance with the contractual agreement and will be retained by AECOM along with associated field records and other related correspondence.

Final evidence files as retained by AECOM will include, but not be limited to, correspondence (paper and e-mail), plans, contractual documents, maps and drawings, field data, calculations, assessment reports, laboratory deliverables, progress and data reports. This information will be maintained in a secure area according to the procedures outlined in the LPRRP QMP (AECOM 2009).

<b>Matrix</b>	Separated Solids
<b>Analytical Group</b>	PCBs – Congeners and Homologs
<b>Concentration Level</b>	Low
<b>Sampling SOP</b>	SW-19
<b>Analytical Method/ SOP Reference</b>	AP-3
<b>Sampler's Name</b>	AECOM Field Staff
<b>Field Sampling Organization</b>	AECOM
<b>Analytical Organization</b>	Analytical Perspectives
<b>Number of Sample Locations</b>	6

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	DQI	Measurement Performance Criteria
MB	1/Batch (20 samples)	a) No Target Compound >25% of adjusted QL; b) If detected, the concentration should be less than the QL or <10x the highest concentration found in the sample batch; c) S/N should be >10:1 for isotopically labeled standard added before extraction; d) EDL ≤ 50% of the adjusted QL	Assess impact on data; qualify data as necessary	Analyst/Section Supervisor	Accuracy/Bias	a) No Target Compound >25% of adjusted QL; b) If detected, the concentration should be less than the QL or <10x the highest concentration found in the sample batch; c) S/N should be >10:1 for isotopically labeled standard added before extraction; d) EDL ≤ 50% of the adjusted QL
Instrument Blank	Once per 12 hours if MB is not run	e) recoveries of the isotopically labeled standard should be 40% minimum or meet the requirements of c and d above.	Assess impact on data; qualify data as necessary	Analyst/Section Supervisor	Accuracy/Bias	e) recoveries of the isotopically labeled standard should be 40% minimum or meet the requirements of c and d above.
Equipment Rinsate Blank	1 per week per sampling team per task	No Target Compounds >1/10 concentration in associated samples	Assess contamination sources in the field and/or in supplies; qualify data as necessary	AECOM FTM/ Data Validators	Accuracy/Bias from Contamination	No Target Compounds >1/10 concentration in associated samples



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### QAPP Worksheet #28 (UFP-QAPP Manual Section 3.4) QC Samples Table

Batch Control Spike	1/Batch (20 samples)	Native compounds by isotope dilution %D vs. ICAL $\leq$ 30%; Native compounds measured against an isotopic isomer vs. ICAL %D = 50%; Labeled standard %D vs. ICAL $\leq$ 50%; Native Compound RPDs $\leq$ 20% for isotope dilution and $\leq$ 30% for isotopic isomer; Standard RPDs $\leq$ 50%	Reanalyze affected samples. Qualify data as needed.	Analyst/Section Supervisor	Accuracy/Bias	Native compounds by isotope dilution %D vs. ICAL $\leq$ 30%; Native compounds measured against an isotopic isomer vs. ICAL %D = 50%; Labeled standard %D vs. ICAL $\leq$ 50%; Native Compound RPDs $\leq$ 20% for isotope dilution and $\leq$ 30% for isotopic isomer; Standard RPDs $\leq$ 50%
Pre-extraction Internal Standards	Spiked into every sample and QC sample	Per EPA Method 1668B Table 6	Check all calculations for error; ensure that instrument performance is acceptable; Assess impact on data; Re-analyze or qualify data as necessary.	Analyst/Section Supervisor	Accuracy/Bias	Per EPA Method 1668B Table 6
Field Duplicate	1/20 field samples	RPD $\leq$ 50% if both samples are $>$ 5x EML or absolute difference between concentrations $<$ 2x EML if sample and/or field duplicate are $<$ 5x EML	Evaluate during data validation. Qualify data.	Data Validators	Precision <sup>a</sup>	RPD $\leq$ 50% if both samples are $>$ 5x EML or absolute difference between concentrations $<$ 2x EML if sample and/or field duplicate are $<$ 5x EML
PE	1	Supplier Certified Limits	Provide feedback to laboratory/laboratory reviews data and implements CA as necessary.	AECOM Chemists/Laboratory Staff	Accuracy/Bias	Supplier Certified Limits

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### QAPP Worksheet #28 (UFP-QAPP Manual Section 3.4) QC Samples Table

<sup>a</sup> Field duplicates (co-located samples) will be the only precision DQI for the HV solids samples. Laboratory duplicates are not possible, as the entire sample is required for the extraction, and cannot be split.

<b>Matrix</b>	Sorption Media (PUF)
<b>Analytical Group</b>	PCBs – Congeners and Homologs
<b>Concentration Level</b>	Low
<b>Sampling SOP</b>	SW-19
<b>Analytical Method/ SOP Reference</b>	AP-3
<b>Sampler's Name</b>	AECOM Field Staff
<b>Field Sampling Organization</b>	AECOM
<b>Analytical Organization</b>	Analytical Perspectives
<b>Number of Sample Locations</b>	6

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	DQI	Measurement Performance Criteria
MB	1/Batch (20 samples)	a) No Target Compound >25% of adjusted QL; b) If detected, the concentration should be less than the QL or <10x the highest concentration found in the sample batch; c) S/N should be >10:1 for isotopically labeled standard added before extraction; d) EDL ≤ 50% of the adjusted QL	Assess impact on data; Re-analyze or qualify data as necessary	Analyst/Section Supervisor	Accuracy/Bias	a) No Target Compound >25% of adjusted QL; b) If detected, the concentration should be less than the QL or <10x the highest concentration found in the sample batch; c) S/N should be >10:1 for isotopically labeled standard added before extraction; d) EDL ≤ 50% of the adjusted QL



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### QAPP Worksheet #28 (UFP-QAPP Manual Section 3.4) QC Samples Table

Instrument Blank	Once per 12 hours if MB is not run	e) recoveries of the isotopically labeled standard should be 40% minimum or meet the requirements of c and d above.	Assess impact on data; Re-analyze or qualify data as necessary	Analyst/Section Supervisor	Accuracy/Bias-	e) recoveries of the isotopically labeled standard should be 40% minimum or meet the requirements of c and d above.
Equipment Rinsate Blank	1 per week per sampling team per task	No Target Compounds > 1/10 concentration in associated samples	Assess contamination sources in the field and/or in supplies; qualify data as necessary	AECOM FTM/ Data Validators	Accuracy/Bias from Contamination	No Target Compounds > 1/10 concentration in associated samples
Batch Control Spike	1/Batch (20 samples)	Native compounds by isotope dilution %D vs. ICAL $\leq$ 30%; Native compounds measured against an isotopic isomer vs. ICAL %D = 50%; Labeled standard %D vs. ICAL $\leq$ 50%; Native Compound RPDs $\leq$ 20% for isotope dilution and $\leq$ 30% for isotopic isomer; Standard RPDs $\leq$ 50%	Reanalyze affected samples. Qualify data as needed.	Analyst/Section Supervisor	Accuracy/Bias	Native compounds by isotope dilution %D vs. ICAL $\leq$ 30%; Native compounds measured against an isotopic isomer vs. ICAL %D = 50%; Labeled standard %D vs. ICAL $\leq$ 50%; Native Compound RPDs $\leq$ 20% for isotope dilution and $\leq$ 30% for isotopic isomer; Standard RPDs $\leq$ 50%
Pre-extraction Internal Standards	Spiked into every sample and QC sample	Per EPA Method 1668B Table 6	Check all calculations for error; ensure that instrument performance is acceptable; assess impact on data; re-analyze or qualify data as necessary.	Analyst/Section Supervisor	Accuracy/Bias	Per EPA Method 1668B Table 6
Static Spikes	Spiked into each sorption media prior to sampling	50-150%	NA, used for informational purposes only	NA, used for informational purposes only	Accuracy/Bias	50-150%



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### QAPP Worksheet #28 (UFP-QAPP Manual Section 3.4) QC Samples Table

Dynamic Spikes	Spiked once into sample stream post filtration/pre PUF when approximately 50% of water volume to be sampled has been pumped	25-150%	NA, used for informational purposes only	NA, used for informational purposes only	Accuracy/Bias	25-150%
Secondary PUF	Added after primary PUF to monitor native compound, static spike, and dynamic spike breakthrough	<20%	NA, used for informational purposes only	NA, used for informational purposes only	Accuracy/Bias	<20%
Field Duplicate	1/20 field samples	RPD $\leq$ 50% if both samples are $> 5x$ EML or absolute difference between concentrations $< 2x$ EML if sample and/or field duplicate are $< 5x$ EML	Evaluate during data validation. Qualify data.	Data Validators	Precision <sup>a</sup>	RPD $\leq$ 50% if both samples are $> 5x$ EML or absolute difference between concentrations $< 2x$ EML if sample and/or field duplicate are $< 5x$ EML
Alternate cleanup standard	Spiked into every sample and QC sample	70-130%	Assess impact on data; Re-analyze or qualify data as necessary	Analyst/Section Supervisor	Accuracy/Bias	70-130%

<sup>a</sup> Field duplicates (co-located samples) will be the only precision DQI for the HV solids samples. Laboratory duplicates are not possible, as the entire sample is required for the extraction, and cannot be split.

<b>Matrix</b>	Separated Solids
<b>Analytical Group</b>	PCDD/Fs
<b>Concentration Level</b>	Low
<b>Sampling SOP</b>	SW-19
<b>Analytical Method/ SOP Reference</b>	AP-1
<b>Sampler's Name</b>	AECOM Field Staff



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### QAPP Worksheet #28 (UFP-QAPP Manual Section 3.4) QC Samples Table

Field Sampling Organization AECOM  
Analytical Organization Analytical Perspectives (Wilmington, NC)  
Number of Sample Locations 6

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	DQI	Measurement Performance Criteria
MB	MB - 1/Batch (20 samples);	a) No Target Compound >25% of adjusted QL; b) If detected, the concentration should be less than the QL or <10x the highest concentration found in the sample batch; c) S/N should be >10:1 for isotopically labeled standard added before extraction; d) EDL ≤ 50% of the adjusted QL	Reanalyze affected samples. A B qualifier is applied to any specific analyte detected in the MB at a concentration above the RL, or the level detected in the blank that is statistically significant relative to that found in the associated sample. An invalid MB requires re-extraction and reanalysis of the samples.	Analyst/Section Supervisor	Accuracy/Bias-	a) No Target Compound >25% of adjusted QL; b) If detected, the concentration should be less than the QL or <10x the highest concentration found in the sample batch; c) S/N should be >10:1 for isotopically labeled standard added before extraction; d) EDL ≤ 50% of the adjusted QL
MB (con't.)		e) recoveries of the isotopically labeled standard should be 40% minimum or meet the requirements of c and d above.				e) recoveries of the isotopically labeled standard should be 40% minimum or meet the requirements of c and d above.
Equipment Rinsate Blank	1 per week per sampling team per task	No Target Compounds >QL	Assess contamination sources in the field and/or in supplies; qualify data as necessary.	AECOM FTM/Data Validators	Accuracy/Bias from Contamination	No Target Compounds > QL



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### QAPP Worksheet #28 (UFP-QAPP Manual Section 3.4) QC Samples Table

Labeled Compounds	1/Batch (20 samples)	EDL<PAL	Reanalyze affected samples if EDL exceeds PAL limit criteria. Qualify data as needed.	Analyst/Section Supervisor	Sensitivity	EDL<PAL
QC Standard	1/Batch (20 samples)	Within statistical control limits	Identify source of variance and assess impact on data reliability. Consider reanalysis of samples if necessary for generating reliable data and sufficient sample is available.	Laboratory Technical Director	Accuracy/Bias	Within statistical control limits
Batch Control Spike	1/Batch (<20 samples)	Native Compound %D (vs. ICAL) $\leq 20\%$ ; Labeled Standard %D (vs. ICAL) $\leq 30\%$ ; Native Compound RPDs $\leq 10\%$ ; Labeled Standard RPDs $\leq 20\%$	Identify source of variance and assess impact on data reliability. Consider re-extraction and reanalysis of samples if necessary for generating reliable data and sufficient sample is available	Laboratory Technical Director	Accuracy/Bias	Native Compound %D (vs. ICAL) $\leq 20\%$ ; Labeled Standard %D (vs. ICAL) $\leq 30\%$ ; Native Compound RPDs $\leq 10\%$ ; Labeled Standard RPDs $\leq 20\%$
Field Duplicate	1/20 field samples	RPD $\leq 50\%$ if both samples are $> 5x$ QL or absolute difference between concentrations $< 2x$ QL if sample and/or field duplicate are $< 5x$ QL	Evaluate during data validation. Qualify data.	Data Validators	Precision <sup>a</sup>	RPD $\leq 50\%$ if both samples are $> 5x$ QL or absolute difference between concentrations $< 2x$ QL if sample and/or field duplicate are $< 5x$ QL
PE Sample	1	Supplier Certified Limits	Provide feedback to laboratory/laboratory reviews data and implements CA as necessary.	AECOM Chemists/Laboratory Staff	Accuracy/Bias	Supplier Certified Limits



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### QAPP Worksheet #28 (UFP-QAPP Manual Section 3.4) QC Samples Table

<sup>a</sup> Field duplicates (co-located samples) will be the only precision DQI for the HV solids samples. Laboratory duplicates are not possible, as the entire sample is required for the extraction, and cannot be split.

Matrix	Sorption Media (PUF)
Analytical Group	PCDD/Fs
Concentration Level	Low
Sampling SOP	SW-19
Analytical Method/ SOP Reference	AP-1
Sampler's Name	Gravity Field Staff
Field Sampling Organization	AECOM
Analytical Organization	Analytical Perspectives (Wilmington, NC)
Number of Sample Locations	6

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	DQI	Measurement Performance Criteria
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### QAPP Worksheet #28 (UFP-QAPP Manual Section 3.4) QC Samples Table

MB	MB - 1/Batch (20 samples);	a) No Target Compound >25% of adjusted QL; b) If detected, the concentration should be less than the QL or <10x the highest concentration found in the sample batch; c) S/N should be >10:1 for isotopically labeled standard added before extraction; d) EDL ≤ 50% of the adjusted QL;	Reanalyze affected samples. A B qualifier is applied to any specific analyte detected in the MB at a concentration above the RL, or the level detected in the blank that is statistically significant relative to that found in the associated sample. An invalid MB requires reanalysis of the samples.	Analyst/Section Supervisor	Accuracy/Bias	a) No Target Compound >25% of adjusted QL; b) If detected, the concentration should be less than the QL or <10x the highest concentration found in the sample batch; c) S/N should be >10:1 for isotopically labeled standard added before extraction; d) EDL ≤ 50% of the adjusted QL;
MB (con't.)		e) recoveries of the isotopically labeled standard should be 40% minimum or meet the requirements of c and d above.				e) recoveries of the isotopically labeled standard should be 40% minimum or meet the requirements of c and d above.
Equipment Rinsate Blank	1 per week per sampling team per task	No Target Compounds >QL	Assess contamination sources in the field and/or in supplies; qualify data as necessary.	AECOM FTM/Data Validators	Accuracy/Bias from Contamination	No Target Compounds > QL
Labeled Compounds	1/Batch (20 samples)	EDL<PAL	Reanalyze affected samples if EDL exceeds PAL limit criteria. Qualify data as needed.	Analyst/Section Supervisor	Sensitivity	EDL<PAL
Static Spikes	Spiked into each sorption media prior to sampling	70-130%	NA, used for informational purposes only	NA, used for informational purposes only	Accuracy/Bias	70-130%



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### QAPP Worksheet #28 (UFP-QAPP Manual Section 3.4) QC Samples Table

Dynamic Spikes	Spiked once into sample stream post filtration/pre PUF when approximately 50% of water volume to be sampled has been pumped	40-130%	NA, used for informational purposes only	NA, used for informational purposes only	Accuracy/Bias	40-130%
Secondary PUF	Added after primary PUF to monitor native compound, static spike, and dynamic spike breakthrough	Recovery in secondary PUF < 20% of recovery in primary PUF	NA, used for informational purposes only	NA, used for informational purposes only	Accuracy/Bias	Recovery in secondary PUF < 20% of recovery in primary PUF
QC Standard	1/Batch (20 samples)	Within statistical control limits	Identify source of variance and assess impact on data reliability. Consider reanalysis of samples if necessary for generating reliable data and sufficient sample is available.	Laboratory Technical Director	Accuracy/Bias	Within statistical control limits
Batch Control Spike	1/Batch (<20 samples)	Native Compound %D (vs. ICAL) $\leq$ 20%; Labeled Standard %D (vs. ICAL) $\leq$ 30%; Native Compound RPDs $\leq$ 10%; Labeled Standard RPDs $\leq$ 20%	Identify source of variance and assess impact on data reliability. Consider reanalysis of samples if necessary for generating reliable data and sufficient sample is available	Laboratory Technical Director	Accuracy/Bias	Native Compound %D (vs. ICAL) $\leq$ 20%; Labeled Standard %D (vs. ICAL) $\leq$ 30%; Native Compound RPDs $\leq$ 10%; Labeled Standard RPDs $\leq$ 20%



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### QAPP Worksheet #28 (UFP-QAPP Manual Section 3.4) QC Samples Table

Field Duplicate	1/20 field samples	RPD $\leq$ 50% if both samples are $> 5x$ QL or absolute difference between concentrations $< 2x$ QL if sample and/or field duplicate are $< 5x$ QL	Evaluate during data validation. Qualify data.	Data Validators	Precision <sup>a</sup>	RPD $\leq$ 50% if both samples are $> 5x$ QL or absolute difference between concentrations $< 2x$ QL if sample and/or field duplicate are $< 5x$ QL
Alternate cleanup standard	Spiked into each extract before cleanup and analysis	70-130%	Identify source of variance and assess impact on data reliability. Consider reanalysis of samples if necessary for generating reliable data and sufficient sample is available	Analyst/Section Supervisor	Accuracy/Bias	70-130%

<sup>a</sup> Field duplicates (co-located samples) will be the only precision DQI for the HV solids samples. Laboratory duplicates are not possible, as the entire sample is required for the extraction, and cannot be split.

Matrix	Water
Analytical Group	General Chemistry - POC
Concentration Level	Low
Sampling SOP	LPR-FI-04
Analytical Method/ SOP Reference	C-16B
Sampler's Name	AECOM Field Staff
Field Sampling Organization	AECOM
Analytical Organization	CAS (Kelso)
Number of Sample Locations	6



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### QAPP Worksheet #28 (UFP-QAPP Manual Section 3.4) QC Samples Table

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	DQI	Measurement Performance Criteria
MB	1/Batch (10 samples)	<0.025 mg/L or <10% of the concentration in the associated samples	Reanalyze affected samples. Qualify data as needed.	Analyst/Section Supervisor	Accuracy/Bias Contamination	<0.025 mg/L or <10% of the concentration in the associated samples
Equipment Rinsate Blank	1 per event per sampling team	No target compound >QL	Assess contamination sources in the field and/or in supplies; qualify data as necessary.	AECOM FTM/Data Validators	Accuracy/Bias Contamination	No target compound >QL
LCS	1 per 10 samples	95-105%R or within the manufacturer's control limits if wider than 95-105%R	Reanalyze affected samples. Qualify data as needed.	Analyst/Section Supervisor	Accuracy/Bias	95-105%R or within the manufacturer's control limits if wider than 95-105%R
LFB	1 per 10 samples	85-115%R	Reanalyze affected samples. Qualify data as needed.	Analyst/Section Supervisor	Accuracy/Bias	85-115%R
Laboratory Duplicate	1 per 10 samples	RPD ≤20% if both samples >10x QL	Reanalyze affected samples. Qualify data as needed.	Analyst/Section Supervisor	Precision	RPD ≤20% if both samples >10x QL
Field Duplicate <sup>a</sup>	1/20 field samples	RPD ≤30% if both samples are >5x QL or absolute difference between concentrations <2x QL if sample and/or field duplicate are ≤5x QL	Evaluate during data validation. Qualify data as needed	Data Validator	Precision	RPD ≤30% if both samples are >5x QL or absolute difference between concentrations <2x QL if sample and/or field duplicate are ≤5x QL

<sup>a</sup> The field duplicate will consist of a second sample collected from the 20L carboy, filled concurrent with one of the sub-samples.



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### QAPP Worksheet #28 (UFP-QAPP Manual Section 3.4) QC Samples Table

Matrix	Water
Analytical Group	DOC
Concentration Level	Low
Sampling SOP	LPR-FI-04
Analytical Method/ SOP Reference	C-13, C-16B
Sampler's Name	AECOM Field Staff
Field Sampling Organization	AECOM
Analytical Organization	CAS (Kelso)
Number of Sample Locations	6

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	DQI	Measurement Performance Criteria
MB	1/Batch (20 samples)	No target compound>QL	Reanalyze affected samples. Qualify data as needed.	Analyst/Section Supervisor	Accuracy/Bias Contamination	No target compound >QL
Equipment Rinsate Blank	1 per event per sampling team	No target compound >QL	Assess contamination sources in the field and/or in supplies; qualify data as necessary.	AECOM FTM/Data Validators	Accuracy/Bias Contamination	No target compound >QL
LCS	1/Batch (20 samples)	90-109%R	Reanalyze affected samples. Qualify data as needed.	Analyst/Section Supervisor	Accuracy/Bias	90-109%R
LCSD	1/Batch (20 samples)	RPD $\leq$ 20%	Reanalyze affected samples. Qualify data as needed.	Analyst/Section Supervisor	Precision	RPD $\leq$ 20%
Inorganic Carbon Spike	1/Batch (20 samples)	$\leq$ 110% of the unspiked sample	Reanalyze affected samples. Qualify data as needed.	Analyst/Section Supervisor	Accuracy/Bias	$\leq$ 110% of the unspiked sample
MS	1/Batch (20 samples)	80-120%R	Flag data. Discuss in narrative.	Analyst/Section Supervisor	Accuracy/Bias	80-120%R



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MSD	1/Batch (20 samples)	RPD $\leq$ 20%	Reanalyze affected samples. Qualify data as needed.	Analyst/Section Supervisor	Precision	RPD $\leq$ 20%
Field Duplicate <sup>a</sup>	1/20 field samples	RPD $\leq$ 30% if both samples are $>5\times$ QL or absolute difference between concentrations $<2\times$ QL if sample and/or field duplicate are $\leq 5\times$ QL	Evaluate during data validation. Qualify data as needed	Data Validator	Precision	RPD $\leq$ 30% if both samples are $>5\times$ QL or absolute difference between concentrations $<2\times$ QL if sample and/or field duplicate are $\leq 5\times$ QL

<sup>a</sup> The field duplicate will consist of a second sample collected from the 20L carboy, filled concurrent with one of the sub-samples.

Matrix Water  
Analytical Group SSC  
Concentration Level Low  
Sampling SOP LPR-FI-04  
Analytical Method/ SOP Reference C-17  
Sampler's Name AECOM Field Staff  
Field Sampling Organization AECOM  
Analytical Organization CAS (Kelso)  
Number of Sample Locations 6

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	DQI	Measurement Performance Criteria
MB	1/Batch (20 samples)	No target compound $>QL$	Reanalyze affected samples. Qualify data as needed.	Analyst/Section Supervisor	Accuracy/Bias Contamination	No target compound $>QL$



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### QAPP Worksheet #28 (UFP-QAPP Manual Section 3.4) QC Samples Table

Equipment Rinsate Blank	1 per event per sampling team	No target compound >QL	Assess contamination sources in the field and/or in supplies; qualify data as necessary.	AECOM FTM/Data Validators	Accuracy/Bias Contamination	No target compound >QL
Laboratory Duplicate	1/Batch (20 samples)	RPD $\leq 20\%$	Reanalyze affected samples. Qualify data as needed.	Analyst/Section Supervisor	Precision	RPD $\leq 20\%$
Field Duplicate <sup>a</sup>	1/20 field samples	RPD $\leq 30\%$ if both samples are $>5\times$ QL or absolute difference between concentrations $<2\times$ QL if sample and/or field duplicate are $\leq 5\times$ QL	Evaluate during data validation. Qualify data as needed	Data Validator	Precision	RPD $\leq 30\%$ if both samples are $>5\times$ QL or absolute difference between concentrations $<2\times$ QL if sample and/or field duplicate are $\leq 5\times$ QL

<sup>a</sup> The field duplicate will consist of a second sample collected from the 20L carboy, filled concurrent with one of the sub-samples.

<b>Sample Collection Documents and Records</b>	<b>On-site Analysis Documents and Records</b>	<b>Off-site Analysis Documents and Records</b>	<b>Data Assessment Documents and Records</b>	<b>Other</b>
Field notes, field data sheets, field logbooks, electronic data (YSI casts, LISST data), navigation data	Field notes, field data sheets, field logbooks, electronic data (YSI casts, LISST data), flow rates, sample volume, DS injection	Custody records and copies of airbills	Reports of field sampling audits	Progress reports
Custody records and airbills	Field instrument calibration records	Analytical data packages and EDDs	Reports of laboratory audits	HV Field and Data Report - Prepared and submitted to clients and USEPA.
Communication logs, records or copies of pertinent e-mails	Field measurement data	Communication logs	Validation reports	
QAPP and HASP	QAPP and HASP	Laboratory notebooks and bench sheets documenting sample preparation and analysis	QA reports to management	
Correction action reports and results	Correction action reports and results	Instrument maintenance and calibration records, standard preparation and traceability records	CA reports and results	
Documentation of field modifications	Documentation of field modifications	Laboratory SOPs and documentation of method modifications	Internal laboratory assessments, including internal audits, third-party audit reports, and PE results	
Daily Activity Log	Daily Activity Log	CA logs and documentation of CA results	Results of PE samples	

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### ***QAPP Worksheet #29 (UFP-QAPP Manual Section 3.5.1) Project Documents and Records Table***

This section describes the project data management process tracing the data from their generation through final use and/or storage. All project data, communications, and other information must be documented in a format useable to project personnel.

#### **Project Document Control System**

Project documents are controlled by AECOM's Project Document Control Manager who will maintain and manage hardcopies and electronic copies of all project related documents according to the LPRRP QMP (AECOM 2009). Electronic copies of all information relating to this project are maintained on the project network files which are backed up at least once per day; access to these files is limited to authorized project personnel. All project data and information must be documented in a standard format which is usable by all project personnel.

#### **Data Recording**

Data generated during this project will be captured electronically or entered by hand into bound field or laboratory logbooks or preprinted forms (refer to SOP LPR-G-01 in Appendix A). Computer generated laboratory data will be managed using the laboratory information management system (LIMS); the LIMS used by subcontracted laboratories are described in their QA documentation.

#### **Data Quality Assurance Procedures**

AECOM will monitor the progress of sample collection to verify that samples are collected as planned. The progress of sample collection and processing will be monitored through the documentation of samples collected and shipped each day. The participating laboratories must maintain a formal QMP to which they adhere and which addresses all data generating aspects of daily operations. A policy of continuous improvement will allow all data generation processes to be reviewed and modified as needed to meet project objectives. Periodic audits of field and laboratory operations will ensure that data collection, documentation and QC procedures are being followed.

#### **Laboratory Data Transmittal**

Laboratory data are managed by the laboratory's LIMS beginning with the sample receiving process. Laboratories are required to provide validated data reports (sample results, QC summary information, and supporting raw data) including EDDs within the turnaround times specified in Worksheet #30. EDDs will be provided in an Earthsoft EQulS® four-file format (modified by AECOM), using reference file tables provided by AECOM. All EDDs will be checked prior to transmittal to AECOM using current versions of Earthsoft's Electronic Data Processor (EDP).



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### ***QAPP Worksheet #29 (UFP-QAPP Manual Section 3.5.1) Project Documents and Records Table***

#### **Data Storage and Retrieval**

Completed forms, logbooks, photographs, data packages, and electronic files will be transmitted regularly to the Project Document Control Manager. Each laboratory will maintain copies of all documents it generates as well as backup files of all electronic data relating to the analysis of samples. Raw data and electronic files of all field samples, QC analyses and blanks must be archived from the date of generation and maintained by each laboratory in accordance with the terms of the contract between AECOM and the laboratory. Project closeout will be conducted in accordance with contractual guidance. As required by the Settlement Agreement all data and other project records will be made available to USEPA.

Data transfer to USEPA will include a standardized EDD that conforms to the EPA Region 2 EDD format as described in <http://www.epa.gov/Region2/superfund/medd.htm> (USEPA, 2012). The EDD will include all qualified and rejected data (including the reported, numerical value for rejected data).

Matrix	Analytical Group	Concentration Level	Sample Locations/ ID Number	Analytical SOP	Data Package Turnaround Time <sup>a, b</sup>	Laboratory/ Organization	Backup Laboratory/ Organization
Solid <sup>c</sup>	PCBs (Homologs and Congeners)	Low	All	AP-3	Standard is 45-60 days	Analytical Perspectives 2714 Exchange Dr. Wilmington, NC 28405 Heather Steele 910.794.1613	Test America 5815 Middlebrook Pike Knoxville, TN 37921 John Reynolds 865.291.3000
Solid <sup>c</sup>	PCDD/Fs	Low	All	AP-1	Standard is 45 days	Analytical Perspectives 2714 Exchange Dr. Wilmington, NC 28405 Heather Steele 910.794.1613	Test America 5815 Middlebrook Pike Knoxville, TN 37921 John Reynolds 865.291.3000
Water <sup>d</sup>	POC	Low	All	C-16B	30 days	CAS 1317 South 13 <sup>th</sup> Ave. Kelso, WA 98626 Lynda Huckestein 360.577.7222	TestAmerica 301 Alpha Drive Pittsburgh, PA 15238 Chris Kovitch 412.963.7058
Water	DOC	Low	All	C-13, C-16B	30 days	CAS 1317 South 13 <sup>th</sup> Ave. Kelso, WA 98626 Lynda Huckestein 360.577.7222	TestAmerica 301 Alpha Drive Pittsburgh, PA 15238 Chris Kovitch 412.963.7058
Water	SSC	Low	All	C-17	30 days	CAS 1317 South 13 <sup>th</sup> Ave. Kelso, WA 98626 Lynda Huckestein 360.577.7222	TestAmerica 30 Community Drive, Suite 11 South Burlington, VT 05403 Kris Dusablon 865.291.3000

<sup>a</sup> Turnaround time is in calendar days from receipt of the last sample in the data package sample delivery group (SDG).

<sup>b</sup> Samples from the first event will be submitted for 30-day rapid turnaround time.

<sup>c</sup> Separated solids and sorption media

<sup>d</sup> The water samples are shipped to the Kelso facility where the samples are filtered. The filter cakes are shipped for the POC analysis to the Tucson facility at the following address: CAS, 3860 S. Palo Verde Road, Suite 302, Tucson, Arizona 85714. The filtrates are retained at the Kelso facility for the DOC analysis. All laboratory project management and data reporting is handled through the Kelso facility.

Assessment Type	Frequency	Internal or External	Organization Performing Assessment	Person(s) Responsible for Performing Assessment	Person(s) Responsible for Responding to Assessment Findings	Person(s) Responsible for Identifying and Implementing CA	Person(s) Responsible for Monitoring Effectiveness of CA
Safety Audit	Once, during the first week of field work	Internal	AECOM	AECOM Regional EHS Manager	AECOM FTM, SSO, and Task Manager	AECOM FTM, SSO and Task Manager	AECOM Regional EHS Manager
Technical Audit of Field Activities	Once during the first few days of field operations; follow-up audits as necessary	Internal	AECOM	AECOM Project QA Manager	AECOM, FTM and Task Manager	AECOM, FTM and Task Manager	AECOM Project QA Manager
Internal Lab Audits	Per laboratory QMP; at least annually	Internal	Laboratory	Laboratory QA Officer or designee	Laboratory management and staff	Laboratory management and staff	Laboratory QA Officer
External Lab Audits	Audit will be performed at least annually.	External	State or national certifying authority.	State or national certifying authority auditor.	Laboratory management and staff	Laboratory management and staff	Laboratory management and staff; AECOM Project QA Manager or designee.
Project-Specific Laboratory Readiness Review	Review will be performed in advance of field work or during the initial stages.	External	AECOM	AECOM Project QA Manager, Project Chemist, or designee	Laboratory management and staff	Laboratory management and staff	Laboratory management and staff.
PE samples	1 per 20 field samples (see Worksheet #32). <sup>a</sup>	External	AECOM	AECOM Project QA Manager, Project Chemist, or designee	Laboratory management and staff	Laboratory management and staff	Laboratory management and staff; AECOM Project QA Manager or designee.

<sup>a</sup> PCDD/Fs and PCBs (Homologs and Congeners) PE samples, which are not blind and have known concentrations, will be submitted with sample shipments at a rate of 1 per 20 separated solids samples. PE samples will not be submitted for the non-HOC analytes. See Worksheet #20 for more details.

Assessment Type	Nature of Deficiencies Documentation	Individual(s) Notified of Findings	Timeframe of Notification	Nature of CA Response Documentation	Individual(s) Receiving CA Response	Timeframe for Response
Field System Audit	Written audit report	AECOM PM, AECOM Task Manager, AECOM FTM, CPG QA Coordinator	Verbal summary of major findings within 24 hours; written report within one week.	Memo with possible re-audit	AECOM Project QA Manager, AECOM PM, AECOM Task Manager, CPG QA Coordinator, USEPA RPMs	One week
Internal Laboratory Audits	Written audit report	Laboratory Manager	Major deficiencies within 24 hours; written report as required by laboratory QMP	Memo or as required by laboratory QMP	Laboratory Manager, Laboratory PM  AECOM Project Chemist, AECOM Project QA Manager, AECOM Task Manager, CPG QA Coordinator, USEPA RPM, USACE PM (if project DQOs are affected)	As required by laboratory QMP
External Laboratory Audits by third-party entities	Written audit report	Laboratory Manager	Major deficiencies communicated orally at exit meeting; written report based on policy of external auditing organization	Letter or as required by external auditing organization with possible re-audit	External auditing organization  AECOM Project Chemist, AECOM Project QA Manager, AECOM Task Manager, CPG QA Coordinator, USEPA RPM, USACE PM (if project DQOs are affected)	As required by external auditing organization
PE samples*	PE results table	Laboratory Manager	Deficiencies (results outside acceptance range) identified within one week of receiving laboratory results	Request for laboratory investigation into deficiencies and CA, if necessary. CA may include investigation and preparation by the laboratory of a CA report, analysis of a new PE sample, or if AECOM deems appropriate, the analyses may be moved to another lab.	AECOM Project Chemist, Project QA Manager, and CPG QA Coordinator	One week



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\*Contingent upon schedule. Refer to the discussion below.

#### **Non-Conformance/QC Reporting**

A non-conformance is defined as an identified or suspected deficiency in, or deviation from, procedures described in an approved document (e.g., improper sampling procedures, improper instrument calibration, errors in calculations or errors in computer algorithms); an item where the quality of the end product itself or subsequent activities conducted using the document or item would be affected by the deficiency; or an activity that is not conducted in accordance with established plans or procedures. Any project staff member that discovers or suspects a non-conformance is responsible for initiating a non-conformance report to the HV CWCM Task Manager, who will evaluate each non-conformance report and assign responsibility for the CA. The HV CWCM Task Manager will verify that the nonconforming item or procedure is not used until the CA has been performed and found to produce acceptable results. If the non-conformance involves instrumentation or equipment, the device must be tagged to indicate it is defective and not to be used.

Each non-conformance report will be reviewed by the AECOM QA Manager and added to the project file.

#### **Assessment**

Assessment activities will measure the effectiveness of the project implementation and associated QA/QC activities. Audits are used as a means of monitoring the performance of field and laboratory activities and are conducted by the Project QA Manager or another qualified individual. Audits will include systems audits which are more qualitative in nature and will be made at appropriate intervals to ensure that all aspects of the QA program are operative. Performance audits are quantitative audits which are conducted to assess the accuracy of measurement systems; this would include the use of PE samples.

Systems audits will be conducted for field and laboratory operations to assess implementation of QA/QC requirements and determine if the systems under review are capable of meeting project DQOs. Any minor deficiencies noted during an audit will be corrected as soon as possible according to an agreed upon schedule. If a major deficiency is noted during an audit a stop work order will be issued until the deficiency can be corrected and the effectiveness of the CA measured and documented. A stop work order may be issued by the Project QA Manager who will notify the AECOM Task Manager and the AECOM PM. The conditions which lead to a stop work order must be documented in sufficient detail to clearly define the problem and identify possible corrective measures. All communications among project staff which address evaluation of the problem and appropriate solutions must be attached to the stop work order. The Project QA Manager, the AECOM Task Manager, and AECOM PM must agree in writing to resume



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work after review of the data supporting correction of the deficiency. The Project QA Manager will maintain a CA log which lists deficiencies that were noted, the individual(s) responsible for follow-up, documentation of the effectiveness of the CA taken, and implementation of procedures to prevent recurrence of the problem.

A written report will be prepared for all audits regardless of the outcome and submitted to the AECOM Task Manager, AECOM PM, CPG QA Coordinator, USEPA RPM, and USACE PM. Any modifications to the existing program, CA required, or the need for additional audits will be documented.

In addition to participation in any audits conducted by AECOM QA personnel, participating laboratories are required to take part in regularly scheduled performance evaluations and audits required by state and federal agencies as part of ongoing certification or participation in specific contracts and to provide copies of the results of these PE samples and audits to the Project Chemist. Any change in laboratory ownership, management, or certification status must be immediately reported to the Project Chemist. If any laboratory analysis is found to be out of control, the laboratory must immediately implement CA and notify the Project Chemist. The laboratory PM will be responsible for documenting the effectiveness of the CA measures before continuing analysis of project samples.

In addition to evaluation of PE data performed by the laboratories as part of their routine participation in USEPA Water Supply (WS) and Water Pollution (WP) certification programs, the primary laboratory performing the PCDD/Fs and PCBs (Homologs and Congeners) analyses will analyze known PE samples, which are not blind, that will be submitted with sample shipments at a rate of one per 20 separated solids samples. If the HV CWCM program occurs within six months of the LRC SSP and RM 10.9 supplemental programs and the same laboratories will be used for the LRC SSP and RM 10.9 supplemental program analyses, a pre-program PE study will not be performed prior to the HV CWCM program. A pre-program PE study will be conducted if there is a change in laboratories.

<b>Type of Report</b>	<b>Frequency</b>	<b>Projected Delivery Date(s)</b>	<b>Person(s) Responsible for Report Preparation</b>	<b>Report Recipient(s)</b>
Progress Reports	Monthly	Due the 15th of each month	AECOM PM / CPG Project Coordinator	USEPA RPM
Audit Reports	Per Audit Schedule in Worksheet #31	Within one month of completion of audit.	AECOM Project QA Manager	AECOM Task Manager, AECOM PM, CPG QA Coordinator, USEPA RPM, USACE PM
Data Validation Reports	After laboratory data are received and validated	See Worksheet #16	AECOM Data Validation Task Manager	AECOM Project QA Manager, Task Manager, and AECOM PM
Nonconformance report	As needed	When a nonconformance is identified	AECOM staff	AECOM Project QA Manager, AECOM Task Manager, USEPA RPM
CA Reports	When CA is required	When CA is implemented	AECOM Project QA Manager or designated Task Manager	AECOM PM, AECOM Task Manager, and Project Team Members, CPG QA Coordinator, CPG Project Coordinator, USEPA RPM

Verification Input	Description	Internal/ External	Responsible for Verification)
Field data	Field data will be reviewed for completeness, accuracy and agreement with SOP LPR-G-01 (Field Records).	Internal	AECOM FTM or designee
Chain-of-Custody	The COC will be reviewed initially in the field for complete and correct information.	Internal	AECOM FTM or designee
	Upon receipt at the laboratory the COC will be compared to sample containers and any discrepancies will be resolved.	External	Laboratory Sample Custodian
	During validation the COC will be verified against laboratory receipt and reporting information.	External	Data Validator
Laboratory Data Packages and EDD	Laboratory data (hard copy and EDDs) will be verified by the laboratory performing the work for completeness and technical accuracy prior to release.	Internal	Laboratory
	Laboratory data will be assessed using the validation procedures described in Worksheets #35 and #36	External	Data Validator
Audit Reports	Audit reports will be reviewed to confirm that specified CA have been taken, the CA has been effective and all documentation of CA is attached to the audit report.	Internal	AECOM Project QA Manager
Assessment actions and reports	QA/QC process will be reviewed for agreement with QAPP	External	ddms, Inc.

Step IIa/IIb	Validation Input	Description	Responsible for Validation
IIa	Field SOPs, field records	Verify conformance to approved sampling and field measurement procedures; ensure that activities met performance criteria; and verify that deviations from procedures or criteria were documented.	Debra Simmons, Project QA Manager/AECOM
IIa	Analytical data deliverables, contractual documents	Verify the required deliverables, analyte lists, method holding times, analytical procedures, laboratory qualifiers, measurement criteria, project QLs, and analyses of PE samples conform to specifications. Verify that deviations from procedures or criteria were documented.	Lisa Krowitz, Validation Coordinator/AECOM
IIa	Field records, database output	Verify transcription of field data from field forms to database.	Jim Herberich, Data Management Task Manager/AECOM
IIa	Custody records, analytical data reports	Review traceability from sample collection through reporting.	Lisa Krowitz, Validation Coordinator/AECOM
IIa	Laboratory EDDs, analytical data reports, database output	Verify EDDs against hard-copy analytical reports.	Jim Herberich, Data Management Task Manager/AECOM
IIa	Data validation reports, database output	Verify that entry of qualifiers was correct and complete.	Lisa Krowitz, Validation Coordinator/AECOM
IIb	Analytical data reports	Verify that reported analytes, holding times, analytical procedures, measurement criteria, and project QLs conform to the QAPP. Verify that deviations from procedures or criteria were documented.	Lisa Krowitz, Validation Coordinator/AECOM
IIb	Analytical data reports, validation guidance	One hundred percent of the data will be validated (see details below)	Lisa Krowitz, Validation Coordinator/AECOM
IIb	QAPP, analytical data reports, validation guidance	Verify that the qualifiers applied during validation were in conformance with the QAPP and specified validation guidance.	Lisa Krowitz, Validation Coordinator/AECOM
IIb	Analytical data reports	Verify that PE samples were analyzed at the frequency specified in the QAPP and met the acceptance criteria.	Lisa Krowitz, Validation Coordinator/AECOM
IIb	QAPP, data validation reports	Verify that data validation was performed in accordance with the QAPP specifications and that all required peer reviews were conducted. If validation actions deviated from the QAPP specifications and/or regional validation guidance based on professional judgment, verify that rationale was documented.	Debra Simmons, Project QA Manager/AECOM



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### ***QAPP Worksheet #35 (UFP-QAPP Manual Section 5.2.2) Sampling and Analysis Validation (Steps IIa and IIb) Process Table***

#### **Data Validation**

Validation of each analytical group will be limited to the target analytes listed in Worksheet #15 for that group. Due to the low number of samples collected, 100% full validation (includes review of raw data and spot check for verification of calculations) will be conducted for PCDDs/Fs (the 2,3,7,8-substituted Congeners and Homologs listed in Worksheet #15), all 209 PCB Congeners and Homologs, SSC, DOC and POC for each SDG. Validation qualifiers will be applied based on the criteria in the QAPP, method-specific Region II validation SOPs, or professional judgment. These will include "J", "UJ", "K", "R", and "NJ", as defined in the Region II validation SOPs. In addition, Estimated Maximum Possible Concentrations (EMPCs) will be qualified "Z".

Reports summarizing data qualification as a result of the validation effort will be prepared.

Step IIa/IIb	Matrix	Analytical Group	Concentration Level	Validation Criteria <sup>1</sup>	Data Validator (title and organizational affiliation)
IIa	Solids	PCDD/Fs	Low	Region II validation SOP HW-25; QAPP Worksheets #12, #15, #19, #24, and #28	Lisa Krowitz, Validation Coordinator/LDC <sup>2</sup>
IIa	Solids	PCBs – homologs and congeners	Low- High	Region II validation SOP HW-46; QAPP Worksheets #12, #15, #19, #24, and #28	Lisa Krowitz, Validation Coordinator/LDC <sup>2</sup>
IIa	Water	Wet chemistry (POC, DOC, SSC)	Low	QAPP Worksheets #12, #15, #19, #24, and #28	Lisa Krowitz, Validation Coordinator/LDC <sup>2</sup>
IIb	Solids	PCDDs/Fs	Low	Region II validation SOP HW-25 and/or QAPP Worksheets #12, #15, #19, #24, and #28, whichever is more stringent	Lisa Krowitz, Validation Coordinator/LDC <sup>2</sup>
IIb	Solids	PCBs – homologs and congeners	Low- High	Region II validation SOP HW-46; QAPP Worksheets #12, #15, #19, #24, and #28	Lisa Krowitz, Validation Coordinator/LDC <sup>2</sup>
IIb	Water	Wet chemistry (POC, DOC, SSC)	Low	QAPP Worksheets #12, #15, #19, #24, and #28	Lisa Krowitz, Validation Coordinator/LDC <sup>2</sup>

<sup>1</sup> Validation criteria include professional judgment where appropriate and necessary. Note that the most relevant Region II data validation SOPs are used for validation guidance when there is no SOP for the specified method. In those cases, QAPP Worksheets #12, #15, #19, #24, and #28 and/or the analytical method and laboratory SOPs are used as reference and the most relevant Region II data validation SOPs (as identified above) are used for guidance in applying validation qualifiers. Note this program contains specific elements, such as static and dynamic spikes, which are outside the scope of the Region II validation SOPs. Validation actions for these elements will be addressed in a project-specific addendum that will supplement the existing guidance.

<sup>2</sup> All data validation will be subcontracted to LDC for this program.

**Summarize the usability assessment process and all procedures, including interim steps and any statistics, equations, and computer algorithms that will be used:**

AECOM's data validation subcontractor will validate all laboratory data in accordance with the protocols described in Worksheet #36. The Project QA Manager, in conjunction with the project team, will determine whether the analytical data meet the requirements for use in making decisions related to further actions at the site. The results of laboratory measurements will be compared to the DQOs described in Worksheet #11 of this document.

Concentrations of PCDD/Fs and PCBs obtained from the laboratory will be expressed as pg/sample. To obtain the dry weight basis concentration in solids and the volumetric concentration of dissolved phase in water, the following equations will be used.

Solid Phase

$$[(x \text{ pg}_{\text{COPC}}/\text{separated solids sample} \div y \text{ volume sampled (L}_{\text{water}}\text{)/sample}) \div (z \text{ mg}_{\text{dry weight}} \text{ SSC/L}_{\text{water}} \times \text{g}/1000 \text{ mg})] = \text{pg}_{\text{COPC}}/\text{g}_{\text{dry weight}}$$

Dissolved Phase

$$[x \text{ pg}_{\text{COPC}}/\text{sorbent sample} \div y \text{ volume sampled (L}_{\text{water}}\text{)/sample}] = \text{pg}_{\text{COPC}}/\text{L}_{\text{water}}$$

Four sub-samples of SSC, POC and DOC will be obtained from each location sampled during the HV program. The sub-samples will be used to better establish the concentration of the SSC, POC and DOC in the 20L carboy (representing the HV sample), and the results will be averaged to obtain a single concentration of each analyte. The averaged concentration will be used to represent the SSC, DOC and POC concentrations from each sample will be used in the calculations above. The EDD will include the average of the four samples, plus the error associated with the average (1 sigma). Field duplicates will also be collected to measure precision (see Worksheet #12).

Validation qualifiers will be considered during the calculations. Concentrations considered detected will be handled as-is. For SSC, POC and DOC, non-detects will be treated as zero for averaging, unless all sub-samples are non-detect, in which case the average of the detection limits shall be used to represent the single value (as non-detect).

For the estimation of solid phase and dissolved phase concentrations of PCDD/Fs and PCBs, non-detects shall be calculated using the pg/sample EDLs. All unit conversions will be performed on HRMS data that is recovery corrected, using isotope dilution, by the laboratory. Results will not be recovery corrected for dynamic or static spike recoveries. Total dissolved phase concentrations will be based on the sum of detected amounts in the primary and secondary PUF sorbents.

**Describe the evaluative procedures used to assess overall measurement error associated with the project:**

During the data validation process the validator will use information confirming sample identification; sample preparation; analysis within holding time; instrument calibration data; and results of QC samples designed to assess blank contamination, analytical precision, and accuracy to identify any limitations in data use and, if known, data bias. The validator will apply qualifiers as needed to reflect any limitations on the use of specific data points and prepare a report detailing the information reviewed, data limitations, and overall usability. Patterns of data use limitations or anomalies which become apparent during the validation process will be reviewed with the Project QA Manager and the appropriate laboratory. Data that do not meet the quality acceptance limits of Worksheet #28, or sensitivity of Worksheet #15, or analytical performance criteria specified in Worksheet #12, may be flagged and those flags clearly identified in the database so data users are aware of any limitations associated with data usability. Details of the



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### ***QAPP Worksheet #37 (UFP-QAPP Manual Section 5.2.3) Data Usability Assessment***

problems identified during data validation and the bias in the data will be provided in the associated validation memorandum.

#### **Identify the personnel responsible for performing the usability assessment:**

Data validation will be performed by AECOM's data validation subcontractor under the supervision of the AECOM Validation Coordinator. The usability assessment will be performed jointly by the AECOM, Tierra and CPG project teams and will include input by field personnel, QA staff, and project management.

#### **Describe the documentation that will be generated during usability assessment and how usability assessment results will be presented so that they identify trends, relationships (correlations), and anomalies:**

The documentation generated during data validation will include a comprehensive memorandum that describes the information reviewed the results of this review and provides a recommendation on overall data usability and limitations on specific data points. The memorandum and supporting validation documentation provide information on the samples included in the review and the date they were collected; the condition of samples when received at the laboratory and any discrepancies noted during the receiving process; verification of sample preparation and analysis within the method specified holding time; instrument calibration information; review of associated QC analyses including blanks, LCS, MS, and field and/or laboratory duplicates; and verification of selected reported values from raw data. As a result of this review standard qualifiers are entered into the database so that data users can readily identify any limitations associated with a specific data point.

Assessment of data usability will be performed by AECOM's data validation subcontractor using current USEPA Region II data validation guidance, as modified per Worksheet #36. The results of the Data Usability Assessment will be summarized in the final project report. The following items will be assessed and conclusions drawn based on their results:

**Holding Time:** All sample data will be checked to verify that both sample preparation and analysis were performed within the method required holding time.

**Calibration:** Data associated with instrument calibration and verification of calibration will be reviewed to confirm that all data were generated using properly calibrated instrumentation.

**Accuracy/Bias Contamination:** Results for all field blanks, laboratory MBs, and instrument calibration blanks will be checked against performance criteria specified in Worksheet #28; results for analytes that exceed criteria will be identified and the impact on field sample data will be assessed.

**Accuracy/Bias Overall:** Reported values of LCS, PE samples, MS, static spikes, and dynamic spikes will be evaluated against the spiked or certified

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concentration and the %R will be calculated and compared to the criteria specified in Worksheet #28. The %R information will be used to assess the bias associated with the analysis. Recovery for MS in conjunction with the recovery reported for performance samples and LCS will provide information on the impact of the sample matrix on specific analyses. Static spikes will be used to evaluate the sorption media's ability to retain sorbed constituents of concern. Dynamic spikes will be used to evaluate the HV sampling system's overall ability to capture the dissolved fraction of the constituents of concern.

**Precision:** Results of the RPD will be calculated for each analyte in laboratory and field duplicates. These RPDs will be checked against measurement performance criteria presented on Worksheet #28; RPDs exceeding the stated criteria will be identified. Additionally the combined RPD of each analyte will be averaged across duplicate pairs whose original and duplicate values are both greater than the QL and a combined overall RPD average will be determined for each analyte in both laboratory and field duplicates. This information will be used to draw conclusions about the precision of the analyses and, for field duplicates, the precision of sampling and analysis. Any limitations on the use of the data will also be described.

**Sensitivity:** During validation, RLs will be checked against expected achievable QLs/EMLs presented on Worksheet #15. Sample-specific factors such as analytical dilutions, percent moisture, and sample volume will affect the achievable laboratory limits. All reported analytical results will be evaluated to determine if adequate sensitivity was achieved. The impact on data usability, limitations on the use of the data, and conclusions about the sensitivity of the analysis will be reported.

**Representativeness:** A review of field records will be used to confirm that sample collection and handling was performed in a manner that conformed to the designated SOP. Similarly laboratory preparation procedures will be reviewed during validation to ensure that a representative sample was selected for analysis. Any deviations or modifications to field or laboratory procedures which might impact the representativeness of the sample will be discussed in the project data report.

**Comparability:** The sampling and analytical procedures which will be used in this program have been selected to ensure that the resulting data will be comparable to data from similar programs conducted previously or which will be conducted in the future. Any modifications or deviations from stated procedures which might impact data comparability will be addressed in the project data report.

**Completeness:** Completeness for the analytical program will be calculated as the number of data points that are accepted as usable based on the validation process divided by the total number of data points for each analysis. Completeness will be reported for each analytical category and an overall value will be reported. As shown in Worksheet #12, the analytical completeness goal is  $\geq 90\%$ . Completeness for the field program will be calculated as the number of samples successfully collected compared to the total number proposed in this QAPP. The completeness goal for the field sampling program is  $\geq 95\%$ .



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### ***QAPP Worksheet #37 (UFP-QAPP Manual Section 5.2.3) Data Usability Assessment***

Each of the PQOs presented on Worksheet #11 will be reviewed to determine if the stated objective was met. The major impacts observed from data validation, DQIs and measurement performance criteria assessments will be used to assess the overall data quality and whether PQOs were achieved. The final data report will summarize the information used to reconcile each objective and overall conclusions regarding data quality.

## **Attachment 1**

### **References**

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# **Appendix A**

## **Field Standard Operating Procedures**

# **Appendix B**

## **Laboratory Standard Operating Procedures**